THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ART OF CANVASSING.

THE business of a canvasser is to procure the customers from whom the profits are to be derived to pay for the following items: Interest on capital; maintenance of plant; working expenses; depreciation (including obsolescence); and a reserve fund for contingencies.

Canvassing is really the commercial management of the enterprise, and is by no means limited to the personal soliciting of custom, which is a mere detail.

In electricity supply this branch of the business is of as much, if not more, importance as the legal, financial and technical work, as upon its success the prosperity of the enterprise depends. This being the problem for solution, how should it be most efficiently worked out?

In introducing an entirely new method of obtaining light and power, the pioneers of the industry experienced practical difficulties which can scarcely be realised at the present day, when tens of thousands of people can bear testimony to the merits of the improved system. And yet there is much spade work to be done, even in the localities where supply works have been established for years, and a considerable amount of business has been secured.

As a general proposition it would seem clear enough that if only a small percentage of converts to the use of electricity are obtained, their example and experience should naturally lead to the rest of the community adopting it. Why do they not do so?

In the first place, it is due to ignorance of the advantages at their disposal. In other cases there are special reasons, such as short tenancies, cost of installations and similar practical difficulties, and innate conservatism, which shrinks from any change, but in the main, progressive principles prevail—the business of the commercial man being to cope with all these obstructions.

There is not much difficulty now in convincing people that electric light is the best form of illumination, but there is still much to be done in satisfying them as to its economy. In the early days of the industry, customers were obtained by guaranteeing that light for light, the cost of electricity should not exceed the cost of gas which it superseded, and probably at the present time such agreements would be found profitable to the supply authorities. The conditions are materially changed, for instead of the flat-flame gas burner, the incandescent mantle is widely used, but the electric lamp has made a still more important advance in the metallic filament, which has decreased consumption by more than two-thirds.

Thanks to the facility for transmitting small fractions of the power of a large engine to any place where it is required, by means of the electric motor, great developments have taken place in the substitution of electricity for steam and gas power. The advantages are as great in this branch of the business as in the use of electricity for domestic purposes, the

main difficulty met with by the canvasser being the cost of changing from the old to the new system—scrapping the obsolete machinery and meeting installation expenses.

The first thing for the commercial manager to do is to organise a good system of publicity for informing the residents of all that the supply authority is prepared to do. The best form of communication is a local pamphlet, containing particulars as to where the mains are laid and a supply of energy is available, the price charged, and how it compares with gas. This can be shown best by a table compiled from the accounts of every class of the company's consumers, showing what they have actually paid for a given installation, so that a ready calculation can be made of the cost.

The local pamphlet should be published quarterly, and contain as many testimonials as possible from satisfied customers of the company, for there is no canvass so valuable as the circulation of the evidence of actual users in the town. In connection with every undertaking there should be a showroom in charge of a practical man, able to explain details.

The terms for the supply of electricity should be fixed upon readily-understood principles.

The quantity of light obtained respectively from gas and electricity for the same outlay can be shown by photometrical measurement, and suppliers may refer with confidence to the results of tests which will prove how much more electric light is obtained for the same money as for gas during the respective lives of the metallic-filament electric lamp and the incandescent gas mantle.

The candle-power should be tested frequently, as the gas mantle falls off rapidly (in more senses than one), whereas the electric lamp retains its efficiency for some 2,000 hours. This might be done systematically at the showroom or works of the company. A gas mantle could be readily tested every day against an electric lamp, and a record kept of candle-power and consumption of energy. This register of actual results should be open to public inspection, and recorded in the local publications used for publicity or canvassing purposes.

A system of this kind would effectually answer the assertions of the gas companies as to the candle-power of these mantles. Recent tests made at Sheerness of the actual candle-power of the street lamps were of especial interest; the details were published in the local papers in November last. Electric lamps were installed in order to test the system against the existing lighting by gas, and careful tests were made with the Trotter photometer; the results were most interesting, as proving the accuracy of the rated candle-power of the metallic-filament lamps, and the great discrepancy between the alleged candle-power of the gas mantle and the actual results shown by the photometer.

Electric lamps rated at 50 c.p. gave respectively 53, 51·5 and 50 c.p., and in one case a nominal 100 gave actually 110!

The gas mantles, on the contrary, made a lamentable show—thus, 80 c.p. nominal proved to give average values of 39·7, 29·8, 26·2, 28·3, 32·7, 33·2 and 34·6 c.p., and in one case a double burner, supposed to be of 160 c.p., proved, on test, to give 85 c.p.

For street lighting the electric metallic-filament lamp is so much superior to gas, through its not being affected by wind and rough weather, that in competition with the gas mantle on legitimate lines it has nothing to fear; hence the recent rapid development of street lighting by electricity.

Copper.

Reductions in stocks this month promise to be heavy, if the amount withdrawn by the 15th inst. is to be taken as a guide. The stocks for mid-month (European), as shown by Messrs. Merton's circular, are 74,960 tons, a reduction of 3,108 tons on the figure for the end of April. The reduction is made up of 1,418 tons from English ports, with 234 tons furnace material from the same, 575 tons less afloat from Chile, and 1,250 less from Australia. Against this there are 369 tons more at French ports. Hamburg is estimated to have taken in 400 tons.

In the detailed supplies North America is slightly over the average, Spain and Portugal the same, Chile shipments are down, but Australian are distinctly higher. Total deliveries, if double the mid-monthly figures, will be high.

The general position, as viewed in many quarters, seems to indicate that, the attempt to curtail output having failed, the price may be expected to remain down. A writer in the *Financier* for May 17th goes so far as to suggest that the arrangements for effecting a combination of the copper-producing companies have fallen through. According to the article, "a spontaneous financial and commercial set-back was accentuated by political difficulties, and the political difficulties have not even yet been got over. The United Metals Selling Co., now under the control of the Amalgamated Copper Co., has, very rightly, not attempted to force prices so far, but the anticipated greater freedom in the market, and consequent more extended buying, has not been realised." The article concludes with the hope that, from now onward to at least the end of the year, the price of copper will remain fairly steady, but the writer regards it as possible that further sagging of quotations may take place. This might result in closing down some of the low-grade mines for a short time.

Surface Condensers.

In Mr. Dexter's recent paper on surface condensers, read before the Manchester Association of Engineers, he rather discounts the value of the sectional draining of tube compartments which has of late been so much advocated. He considers it better to sacrifice the drainage by giving to the steam a direct run through the condenser. The body in cross-section is tapered narrower to the base from a point about one-third of the height below the top; by this means the flow of steam is approximated to the same rapidity all the way down, with a view to sweeping the tubes clear of water by the rush of steam.

But in the illustration of the condenser the upper surface of the top bundle of tubes is shown unbroken. Is it not found that this unbroken tube surface prevents the free access of steam to the main body of tube surface lying in the middle of the mass of tubes? The author is quite right in advising rectangular wide-spreading steam inlets, so as to spread the steam over the full length of the tubes, as well as the provision of deflecting (not baffle plates) to assist this spreading, but the area thus provided for flow is much in excess of the area provided between the tubes of the first row, which are exposed to the fresh steam and do the largest duty.

Would it not be better to provide always more liberal steamways into the heart of the tubes? Steam will condense as soon as it touches a surface colder than the ebullition temperature at the pressure; hence the need to reach all the surface instead of heating up the first presented surface to a non-condensing temperature. The molecules of steam move so rapidly, that in a cold chamber they will find the cold surfaces almost instantaneously. There is no real necessity to cram tubes into needlessly small spaces.

Many engineers seem to be too much obsessed with the space-saving idea; an idea that is carried too far when it results in seriously depreciating the efficiency of expensive machinery and plant.

The duty of the first row of tubes may be several times the mean duty, and the question arises whether, by reducing the number of tubes in order to open up a free way to more tubes, the mean duty of the tubes as a whole might not be increased.

The author's dictum on air pumps is that no rotary or ejector pump can compare in displacement efficiency with a well-designed reciprocating pump, which deals much better with extra air leakage than the rotary pump. He illustrates a neat form of water-sealed flanged joint for exhaust pipes to safeguard them against inward leakage of air. This consists of an annular circular passage cut half in each flange and kept full of water by a supply pipe, so that if leakage occurs it will be of water—not air. A calculation is given, into which suitable factors appear to enter, as to the relative economy of vacua for a steam turbine of 27 in. and 28 in. The electric power to drive the pumps is rated at ½d. per unit, and depreciation of plant at 10 per cent. for condensing plant and 12½ per cent. on cooling towers.

With circulating water at 60° F., the best vacuum is 28½ in.; but when the water reaches 80°, it is better to work at 27 in. The figures are not to be taken too seriously, but they show, no doubt, approximately correct conclusions, and it may generally be said that, in practice, a little less had better be aimed at. But everything should be grasped at that can be got by reducing air leakages. The fashion for metallic packings, proper enough for high-pressure steam, would appear a little out of place for low-pressure rods. These do not burn; low-pressure steam is as cool as it always was when boiler pressures were only a fraction of what they are to-day, and a good fibrous packing may still show better results than modern packings when applied to exhaust glands.

Cables at the Conference.

The Imperial Conference for the consideration of very important subjects, among which is that of telegraphic communication, began on the 23rd inst., and whatever the result may be, there will be placed before all its members the whole aspect of this question, as viewed by those most concerned in it.

Last week the Postmaster-General referred more than once in the House of Commons to the arrangement with the companies with regard to deferred telegrams at a reduction of 50 per cent., but to some parts of the Empire this is a small matter in comparison with the far more important question of better service and lower rates for commercial traffic.

The chief question for consideration at the Conference is stated to be that of Defence, and it will be interesting later to examine how far this may be achieved while the question of completing the telegraphic connections required for this purpose remains unsettled. At present they are incomplete, and there have been placed before the Imperial Government and the delegates various plans, which should now induce executive action.

The question of the control of the Atlantic cables by the Western Union Co. seemingly has not yet been settled. The matter has been referred to in the daily Press, but the various statements do not appear to be quite in accord. The *Times*, of May 22nd, refers to a suggested lease of the cables, under the terms of which the British company would retain its independent existence, and the interests of its stockholders and employés would be safeguarded. This is said to meet with the approval of the Anglo-American Board and its legal advisers.

It is further stated that the powers of the Western Union Co. are doubtless more restricted under this agreement than under the one first contemplated, but the "Vail" interests would still exercise sufficient control to enable them to carry out the forward policy outlined by the president in the statements he has made on the future policy of the combination, and it is stated that a contract in this form would certainly be preferred from the standpoint of public policy. The European manager of the Western Union Co., however, in the *Daily Mail* of May 22nd, looks upon the reforms as an experiment, and the manager of another large cable company states that the companies cannot afford to make any reduction in their rates.

We have already expressed the opinion that if the board be composed of seven directors, and five are appointed by the Western Union Co., there does not seem to be any need for further discussion as to the effect of the agreement.

CONSUMERS SUPPLIED FROM TRACTION CIRCUITS.

By E. P. AUSTIN.

The practice of supplying energy for lighting and power purposes from traction circuits has rapidly grown during the past few years, and the writer proposes to deal with some of the technical problems that belong to this class of service connection, commencing with a consideration of the conditions under which motors, &c., have to work when supplied from circuits of varying voltage and medium potential to earth.

In accordance with Government Regulations, all starters, switches and other accessories must be metal-cased and efficiently earthed, together with the motor frames and beds. Similarly, all wires must be run in an electrically-continuous metal sheath electrically connected to the above-mentioned cases and frames, and in the case of lighting circuits, the sheath should be of steel tubing with the lampholders and fittings screwed on, and the whole system efficiently earthed.

The diagram in fig. 1 (page 828) shows the connection between the traction trolley wire and a consumer's motor. All the apparatus complies with the regulations as regards metal coverings and earth connections, and as the negative conductor is at earth (rail) potential, all apparatus connected to the positive conductor will, therefore, be at medium potential (250 to 650 volts) above earth, in this case about 500 volts. In the event of an insulation breakdown on motor or starter, the positive fuse only is brought into action, and must be capable of opening circuit on a single break at full voltage. The starter should always be connected on the positive side of the motor, so that any insulation defect in the wiring, motor or starter becomes apparent immediately an attempt is made to start up. If, for instance, the starter has gone to frame through one of its resistance elements or internal connections, the motor will refuse to start, as it is shunted by the starter being earthed. If the attendant continues to move the arm over until it reaches the faulty element, the positive fuse will blow, if it has not done so earlier in the operation.

The racing of the motor on starting up indicates field circuit trouble, either a broken connection or leakage to earth causing the field to be shunted.

The only conditions under which both fuses are brought into operation are insulation troubles between poles, the starter in "full on" position when the main switch is closed to start up, and a condition of voltage fluctuation that is peculiar to traction and such-like circuits. This last is the blowing of fuses when the motor is running in good order. The trouble is caused by excessive line drop, due to "dead shorts" or other causes of heavy current, which causes the motor to lose its field. Immediately the voltage rises again a heavy current flows in the armature circuit, as the induction of the field coils prevents the field from attaining its normal strength in time to induce the necessary back E.M.F.

Interpole motors are the best for this class of work, as they are less affected by voltage variation.

Unless there are reasons to the contrary, single-pole control is more satisfactory than double-pole gear, but in cases where two sources of supply are available, one of which is insulated on both poles, the D.P. gear is necessary, and the precautions mentioned in the following paragraphs should be taken when earthing the metal coverings and frames.

The method of making earth connections is a most important point. A common practice is to connect the "earth" end of the earth wire to the negative cable and brush lead, which it is quite safe to do providing that no switch or fuse is used on the negative cable at any point, but if D.P. control is installed, then all earth connections must be made to the negative cable on the rail side of the main switch, as shown in fig. 1.

Under these circumstances, no fuses should on any account be put in circuit between the rail and the point at which earthing wires are connected, and if the negative conductor passes through the pole box, it should be connected solid by

means of a link held in place by screws or nuts instead of the usual removable plug. The only reason for providing a means of disconnection is to facilitate insulation testing.

If there is a length of overhead line between the traction supply and the motor circuit, then, in addition to the above-described earth connection, it is advisable to make another earth to a water pipe that is always full of water or else to a properly constructed earth plate. Of course, the water pipes of a heating system should never be used for earth wire attachments. These precautions are necessary to ensure the continued earthing of the metal coverings in

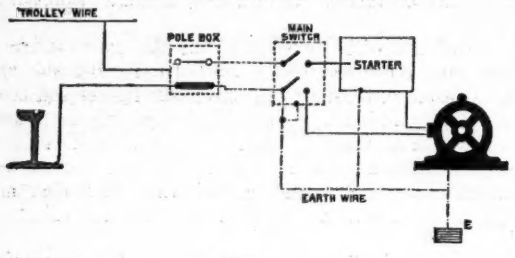


Fig. 1.

the event of the overhead wire falling down. The writer recalls a case in point where the overhead was brought into contact with some spouting during alterations to a roof. The negative cable was burnt through, leaving the positive charged, but owing to the provision of the additional earth circuit, danger of shock from any charged metal coverings was avoided.

A careful choice of the protective and control gear of traction supply circuits is essential, if troublesome delays are to be avoided. Apparatus that works satisfactorily on 500-volt circuits with both poles insulated has been known to fail when installed on circuits supplied from a traction system. This applies in particular to metal-covered fuses and switches that operate on inductive circuits. A number of ironclad fuse designs are faulty in respect of the distance allowed between fuse terminals and unprotected iron cases. Fig. 2 is an example of an ironclad fuse rated at 600 volts, in which

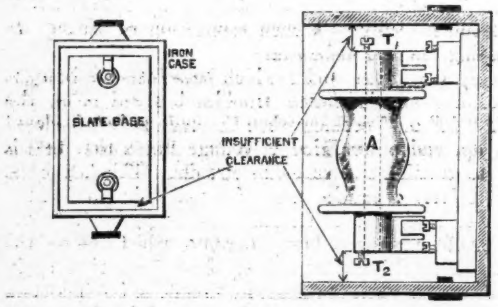


Fig. 2.

Fig. 3.

the distance between the fuse terminal and the earthed iron case is about 14 per cent. of the distance between fuse terminals. Obviously the device is unsuitable for its rating, as the clearance *between poles* is only equivalent to the distance between terminals and case, and the blowing of the fuse will generally result in the arc being maintained between these two points.

Another type of fuse is shown in fig. 3, and is designed for mounting on traction poles. A is a porcelain handle bridge with knife blade and spring jaw contact mounted on a slate base, the whole enclosed in a cast-iron pole box with hinged door. The fuse wire is attached to the terminals T_1 and T_2, and passes through the handle. The defect with this type is the distance usually allowed between the end of the handle fuse and the case, and the arc caused when the fuse operates is blown on to the case and maintained at that point. An insulating or fire-resisting lining is sometimes used in these boxes, and effects some improvement, but it rapidly deteriorates under the action of the arc, and unless the clearance is ample there is a recurrence of the above-mentioned trouble.

The same remarks apply to ironclad switches, and the clearances in this case must be sufficient to allow the positive side of D.P. switches to act successfully as single-pole 600-volt switches.

The design of the pole box is an important point, for its situation in the public street, generally at such a height from the pavement as to render it readily accessible, converts any defect it may possess into a positive source of danger to passers-by.

In the writer's opinion, the pole box should be only a disconnecting box, and contain no fuses. The fuse should be a separate piece of apparatus situated higher up the pole and connected electrically beyond the disconnecting box. It is not necessary for this fuse to be accessible from the ground, as it should operate only in the event of the service connection becoming defective, and would only be replaced after the defect was remedied.

The method of bringing the cable into a pole-box is an important detail. The cables should enter the box on the under side through a properly bushed hole, and the one that is attached to the top terminal should be brought up inside the box and suitably protected from the effects of a blowing fuse. The old dodge of bending the cable in a downwards loop as it leaves the pole is a good one to prevent the water from accumulating on the bush and trickling down the cable. An excellent method is to bring the cables down the outside

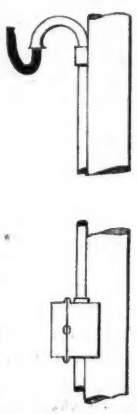


Fig. 4.

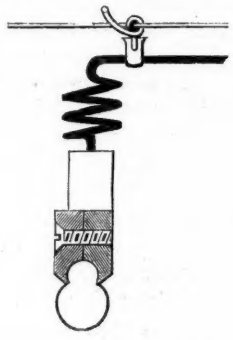


Fig. 5.

of the pole in screwed barrel, terminating in a watertight joint at the box, and, to prevent the water from entering the barrel at the top, a counter bend is used, as shown in fig. 4.

With the type of service described in the foregoing, there are more fuses in circuit than are supplied with the usual street service connection. There is the pole fuse, the service fuse, and main and sub-fuses on the consumers' circuits. All these fuses are working under different conditions of ventilation, type of terminal and length of break, and, to avoid troublesome delays, these points must be taken into account when determining the size of each fuse wire. For instance, the pole-fuse will probably be totally enclosed, and somewhat longer in break than the succeeding fuses, therefore the fuse-wire must be sufficiently long to allow for these points, in addition to its rating of 50 per cent. or so above the other fuses in the same circuit. It should only blow when the cable on the pole or the service cable becomes defective, and its presence is necessary to protect the tramway service from any disturbance due to consumers' connections breaking down.

Whether a supply shall be given from a tramway feeder or from the trolley wire, depends on the demand, the loading of the trolley wire and the geographical position of the feeder and the premises to be supplied.

Motors of moderate size are usually fed from the trolley wire, and the cable is attached by means of a feeder ear. One type of ear is illustrated in fig. 5 for grooved trolley wire. The cable should be brought into the lug on the ear from above in a vertical direction, and not in a horizontal plane, as in the latter case the vertical movement of the trolley wire will eventually break the service cable off.

The behaviour of motors fed off traction supply renders them unsuitable for direct connection to machines that have to maintain an even speed. The voltage variation is sometimes excessive, due to a certain extent to drop in the trolley wire, in addition to feeder drop. Various means of meeting the difficulty are in use, but the most common method is to install boosters on the feeders that are most affected by voltage drop. Such boosters are usually made to raise or lower the voltage automatically on the feeders to which they are connected, and thus keep a steady pressure at the distant point where it is required.

For instance, the station load may require a 12 per cent. increase in voltage to suit the majority of the feeders when only a normal voltage is necessary for an individual feeder supplying a consumer. In such a case the booster would be required to reduce the voltage of this feeder. The more usual conditions necessitate a rise in voltage.

As feeder boosters are usually series machines, some protective device is necessary to prevent reversal and racing if the driving member; probably the most reliable form of switch is one that is mechanically operated by an attachment to the machine shaft, and arranged to short-circuit the machine immediately a reversal takes place. Another form of switch is one that is operated by a small centrifugal oil pump driven from the booster shaft, which maintains the oil at a certain height in a tube. Any reduction in speed, which must precede a reversal, allows the oil level in the tube to fall, and thus operate a suitably-connected circuit-breaker.

Lighting circuits fed off traction supply can only be called satisfactory for general lighting, as series circuits are unavoidable and the excessive voltage variation affects the light to a most trying degree. Arc lighting on this system can be run very successfully, and is suitable for factory, street and public hall lighting. Experiments show that the voltage variation affects the arc to a much smaller degree than it affects incandescent lighting, the variation in the light being barely noticeable to the ordinary observer; and, in fact, the system has been eminently successful with cinematograph lanterns.

When the necessity for constant-speed motors and steady lighting becomes of the first importance, then the most satisfactory method of fulfilling those requirements is to install a motor-generator and some form of voltage regulator to control the generator. A large works can be efficiently equipped with such plant, and in order to provide a stand-by the generator can be made for the same voltage as the supply, and change-over switchgear provided for direct connection when necessary.

Sub-stations for public supply are successfully run on this method, and require little attention, as the voltage regulators are sufficiently reliable to maintain an even pressure under all conditions without an attendant being on duty.

Continuity of supply under these conditions is essential, and to prevent a car breakdown from interfering with consumers, and *vice versa*, special precautions must be taken. Feeder circuit-breakers must have a time limit attachment, and the generators must be similarly equipped, or connected solid on to the bus-bars. Conditions of parallel running generally preclude such a method, but means must be provided for preventing the generators from opening circuit on feeder circuit disturbances.

Trolley-wire connections taken from feeders carrying a joint load must be protected by means of circuit-breakers, which operate an alarm signal on the nearest tramway standard to the feeder connection pillar, in order to attract the motorman's attention to the point of control, in the event of a breakdown or temporary fault causing a circuit-breaker to operate.

A detailed description of a feeder pillar and sub-station working on these lines was given by Mr. Acland in his paper on "Supply to Outlying Districts," read before the M.E.A. in 1907.

A system is in use in Colchester which employs a motor supplied from the tramway system, driving two generators and feeding a three-wire lighting network, each generator being controlled by a separate voltage regulator. A link between lighting and tramway systems is thus established, and a distant point of the lighting network is economically supplied without the use of an additional feeder.

Energy supplied is usually metered by means of a watt-hour-meter, but the writer has found that an ampere-hour meter calibrated to the mean voltage at the consumers' terminals reads correctly within 1½ per cent. In fact, the two types of meter on the same circuit have been found to register the same total.

The absence of a shunt circuit makes it more satisfactory when the daily line tests are taken at the switchboard.

THE ELECTRICAL INDUSTRY IN SOUTH AFRICA.

[COMMUNICATED.]

THE electrical industry of South Africa is somewhat of an alternating nature, owing to the phaseological character of its prosperity. Some two years ago an electrical engineer had a very poor chance of obtaining employment in any of the now Unified Colonies of South Africa, whereas to-day, the position is quite the reverse. Since the advent of "Union" there has been a great revival of trade, and the electrical industry has gone ahead; it has never been in a more flourishing condition than at the present time.

Whether this prosperity is the outcome of "Union," or whether it has been brought about in the ordinary course of events, is an open question, but there is no doubt that "Union" has rendered the entire Colony far more stable financially, and thus all industries have more or less benefited; there is also every indication of a prolonged continuance of this happy state of affairs.

If recent trade statistics are compared with those of three years ago, a very marked increase will be found, and the casual observer cannot fail to be impressed with the large amount of electrical machinery that has passed through Durban during the past few months *en route* for the Rand. This substantial increase of business appears more marked in view of the fact, that, three years ago, hardly a vessel was to be seen in harbour.

South Africa opens up a large field for the electrical engineer of certain qualifications, and the main object of this article is to give the reader an outline of the conditions prevailing there.

The great centre of electrical enterprise is the Rand, or main gold mining area of the Transvaal, and although electricity is appreciably used for lighting and power purposes in practically all the towns, coal mines, sugar estates, &c., it is on the Rand that the great centralisation of the electrical industry is to be found.

There is little or no manufacturing of electrical goods in South Africa, these all being imported from the British Isles and America, and from Germany and other Continental countries. Whether this will be altered in the near future it is difficult to surmise, let alone prophesy, although the natural products of the country and the supply of cheap power tend towards the country producing its own manufactures.

In other industries large British firms have recently laid down extensive manufacturing works where the local products and conditions enable them to compete with imported articles. It is also a feature of these works that all the machinery is electrically driven.

The Victoria Falls Co. has practically the monopoly of supplying electricity in bulk on the Rand; although originally intended to utilise the Victoria Falls, this company generates its power through the medium of steam stations, and has bought up the Brakpan and the General Electric Power Companies, originally the two largest supply companies. It is hardly to the credit of the British bankers and investors that the German has got such a large financial interest in this important company, as the influence of this factor on the electrical industry of the Rand is great, and will become more so as its field of operations increases, as it is bound to do in the near future.

At the present time, however, there is plenty of scope for the British electrician or engineer, but he must be practical and be able, if necessary, to actually do the work of the artisan more or less skilfully, as many first-class engineers have failed to get employment through not being proficient

in this respect. In most instances, when applying for a position on the mines, an engineer (if he appears suitable) will be tested in some practical manner, and will have to install electrical machinery or appliances with the aid of unskilled labourers; and if he is unable to carry out this work, he will be given very short notice to quit. It is not in any way *infra dignitate* in South Africa for any man to work thus, as practically all those holding responsible positions have had to do so at the commencement of their South African career. A few months ago a young engineer sought employment on the Rand, and had over 20 offers of employment during a short visit; he accepted a very lucrative and responsible position as chief electrician to a large mine. In many instances recently wiremen have been offered 25s. a day, with overtime, and a three-years' agreement, but these men have been wiremen and not that class of man who, when his work is inspected, is found to have wired most of the lights in "series," and forgotten how to use a soldering iron, or when employed as an armature winder to repair a burnt-out C.C. motor-armature, states, after four or five hours' flourishing of a brand-new slide rule, that he can only repair 5,000-KW. three-phase alternators (the writer has had several experiences of such cases). It is the good all-round practical man with a slight sound technical knowledge that will soon make his way on the Rand. A man of this type will at once obtain employment at a wage of 20s. to 25s. a day or a salary of £30—£35 a month, when he will have plenty of opportunity of working his way up to lucrative and more responsible positions. There are also good openings in the commercial world, and at the present time several of the larger South African engineering firms are so busy that the members of their staffs are hardly able to cope with the work. An exceptionally good living can be made by the commercial engineer who knows anything at all about his work.

Many representatives of British firms visit South Africa on business. Some are very successful, but the majority, knowing practically nothing about the local conditions and requirements, run their firms into a great deal of expense and do very little business. It is the man on the spot who can get the business, after he has acquired a slight knowledge of his surroundings, assuming that he is able to quote for the proper class of machinery required, and the cost of installation. Large quantities of machinery and material have been scrapped through the lack of knowledge of local conditions.

As to the cost of living, this varies according to whether the domicile is in Johannesburg or at a mine. If the former a good class of board and lodging can be obtained from £8 to £10 a month, and on the mine at £1 or 30s. less.

The larger mines or groups of mines provide boarding houses, tenements, reading and billiard rooms, &c., for their employés, at nominal cost, and generally free houses for the more important officials, the emoluments of an office increasing, as is usual, with its importance. Clothes and other necessities of life are 50 per cent. to 100 per cent. dearer than at home, but are rapidly becoming cheaper. House rents in Johannesburg are still very high, £10 a month being the rent of a very ordinary house.

In other parts of the Union—Natal, Cape Colony and the Orange Free State—living is much cheaper, but wages are proportionately lower. In Durban (Natal) the wages of a first-class electrician are from 14s. to 16s. per day; very comfortable board and lodging can be obtained for £5 to £6 a month, and other things are, generally, 50 per cent. cheaper than on the Rand.

Generally speaking, the more important parts of South Africa are quite abreast of the times, and this especially applies to electrical engineering; on the Rand are found the latest and most up-to-date electrical machinery and accessories of British, German and American manufacture. Electricity may be said to be always utilised when it can be with any degree of economy and efficiency, and with the great tendency towards the centralisation of its production, the day should not be far distant when coal will be almost entirely used for this purpose, and electricity will be the sole agent for producing light, power and heat, having practically no competitors.

Even in Durban, where coal is dear compared to the cost at the pit's mouth, the municipality have recently entered into an agreement to supply the Government with electricity in bulk at ⅜d. (approximately) per unit, and to take away two 1,000-H.P. turbine sets from the Government's power station and re-install these in their own.

Although these turbines had only been in operation about three years and have been most successful both from the engineering and financial points of view, it was conclusively proved that both parties will immediately benefit by the transaction, and on further development this mutual benefit will materially increase.

The load factor of the Durban Municipal Power Station will be more than doubled, and as its power load is daily increasing, a rosy future appears to be in sight for this already very successful undertaking.

A new country like South Africa, that is going ahead and is untrammelled by any old-fashioned ideas and customs, and has not any large amount of capital sunk in any concern competitive to the development of a commercial electrical power undertaking, opens up an extensive field for the electrical engineer, as he has good opportunities for carrying out, or at any rate, being a participant in the carrying out, in the near future, of electrical power schemes embodying the latest theory and practice.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

'CONSUMER" writes:—"Two shops are supplied with electricity from Corporation mains, one at 105 volts and the other at 200 volts. The consumer complains of the increased bills and the short life of the metal-filament lamps. A voltmeter was fixed at each shop, and recorded 116 to 120 volts in the first case, and 216 volts in the second. Has the consumer any legal redress, as no satisfaction is to be obtained by complaints to the Corporation?"

*** The regulations of the Board of Trade under which electricity is supplied provide that: "The pressure so declared shall be constantly maintained, subject to a variation not exceeding 4 per cent. above or below the declared pressure, under any conditions of supply which the consumer is entitled to receive, or such other variation as the Board of Trade may from time to time allow, and shall not be altered or departed from to an extent greater than that variation, except by consent of the Board of Trade." Upon the facts stated by "Consumer," there appears to be a clear departure by the Corporation from the Board of Trade regulations. Regulation 5 provides that: "If the undertakers make default in complying with any of these regulations as to supply, they shall, subject to the provisions of the order, be liable on conviction to a penalty not exceeding £5 for every default, and to a daily penalty not exceeding £5." It will be necessary, however, for "Consumer" to show that the irregularity in pressure was something more than a mere temporary variation in pressure. He should see a solicitor before moving in the matter.

Territorial Sports.—The London Electrical Engineers Territorial Force held their third annual sports and championships at the London County Athletic Grounds, Burbage Road, Herne Hill, on Wednesday, 17th inst. Lt.-Col. Leaf, the Officer Commanding, was present, together with the following officers, who acted as sports officials: Referee, Major A. E. Le Rossignol; judges, Major J. H. S. Phillips, Capt. W. H. Merrett, Capt. K. Edgcumbe, Second-Lieut. H. C. C. Tufnell; time-keeper, Capt. P. H. Campbell, R.E. (times being taken on a Smith's split-second chronograph). The events were as follows: 100 yards level race, final heat; quarter-mile cycling level race; long jump; 880 yards level race; 120 yards hurdles level race; 1 mile cycling level race; 440 yards level race; high jump; 5 miles level race; and 1 mile level race. For the Inter-Company Tug-of-war the result was: "D" Company, 1; "B" Company, 2; "A" Company, 3.

The 110 and 440 yards swimming level races, which count towards the Inter-Company Cup presented by Major A. E. Le Rossignol, were swum for on 13th inst. at the City of Westminster Baths, Great Smith Street. The Le Rossignol Challenge Cup goes to "C" Company, with a total of 37 points, the other scores being: "D" Company, 15; "B" Company, 13; "A" Company, 13.

At the conclusion of the meeting, the hon. sec. of the Sports Committee, Q.M.-Sergt. Applebee, thanked the Colonel and officers for their attendance and assistance at the Sports, and in replying, Col. Leaf stated that if anyone deserved praise, it was the secretary himself, on whom the onerous duties in connection with the Sports had fallen, and who had carried them out so successfully.

Fatality.—An electrician named James Knuckey, employed on the Cinderella Deep Mine, Johannesburg, was killed on April 29th in a motor-cycle road competition. Whilst taking a corner at a very high speed, deceased dashed into a bank and was thrown heavily on his head. His death occurred whilst being taken in an ambulance to the hospital.

THE WESTMINSTER ELECTRICITY SUPPLY SHOWROOMS.

On Wednesday we were present at the opening of the new demonstration rooms, which have been fitted up in a quite up-to-date and enterprising manner by the Westminster Electric Supply Corporation, Ltd., at their premises at Eccleston Place, Belgravia, S.W. It is not easy to adequately convey a proper idea of the proportions of the "rooms" in pictures, they really require to be seen to be fully appreciated, and we have no doubt that they will speedily have numerous visitors, electrical and otherwise, to admire the excellence of their illumination and general arrangements. The two photographic views that we are able to give, together with the following notes, will, however, convey a sufficient general idea of what has been done and the varied nature of the equipment.

The Kitchen at Eccleston Place.

Several years ago the company laid themselves out to meet the demand for electricity for auxiliary purposes by supplying current to their lighting consumers for cooking and heating, working lifts, and driving motors at 1d. per unit, and the additions to the business for the last two years show that no less than three-quarters of the new connections have been for these purposes; further, the claims of electricity are such that a very big demand must come before long for lighting, heating, cooking, and the supply of hot water in modernly-appointed houses.

The Westminster company has for some years demonstrated the use of electric lamps and appliances on a small scale, but in order to cope with the situation in a thoroughly effective manner, these extensive demonstration rooms have now been built at their head office, in which the latest apparatus and devices of all kinds are installed.

It forms a very fully equipped permanent exhibition, which in some of its features constitutes a new departure. The company do not undertake installation work themselves, and, consequently, all fittings and apparatus are for demonstration only, and not for sale, but consumers within the area of supply have now an excellent opportunity of appreciating the almost unlimited purposes to which electricity may be applied, and electrical contractors engaged in the district are invited to take their clients to inspect the apparatus installed.

In carrying out the scheme of arrangement the company has had more especially in view the practical application of the various systems which may be employed, rather than the mere showing of fittings, for which purpose many excellent exhibitions are already established by manufacturers and contractors.

The demonstration rooms are particularly suitable for displaying various lighting effects, and for this purpose the ceiling has been arranged in groups of lights to produce the following results:—Upward reflection, downward reflection, concealed cornice lighting, ceiling lighting, wall lighting, picture lighting and general diffusion. Arc lighting is also suitably represented.

The possibilities of electric heating are illustrated by means of a variety of appliances, prominent among which are the familiar luminous radiator and the convector, and also a device recently introduced by the company, which is peculiarly suited to London. This is a heater, by means of which fresh air is drawn from outside the building, filtered and warmed before it passes into the room.

A special feature of the demonstration rooms is a bay which has been completely fitted as an electric kitchen. Here a lady expert will give practical cookery demonstrations, and every opportunity will be given to cooks to actually handle and use the apparatus. This lady will also call at consumers' houses to instruct and advise on the use of electrical cooking apparatus.

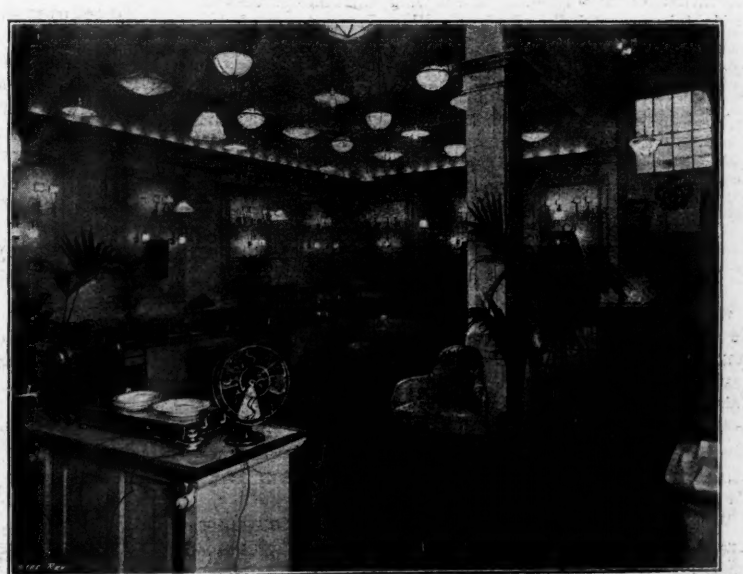
In the kitchen a constant supply of electrically heated water is maintained. Complete electric ranges are installed, and ovens, grills, hot cupboards and miscellaneous cooking utensils are fitted, by means of which every operation in culinary art can be carried out. The actual cost of each operation is shown on special meters provided for this purpose.

Electric ventilating is illustrated by two exhaust fans, one of which is fixed in the kitchen bay to carry away any fumes which may arise from cooking, and another in the main demonstration room.

A representative assortment of minor appliances for general household use—such as vacuum cleaners, flat irons, hair-dryers, knife and boot cleaners—are shown.

Examples of the leading makes of incandescent lamps are fitted on a special panel, and are so arranged that the current consumption and cost of running of any particular lamp can be instantly ascertained. The company has a business-getting staff, consisting of expert engineers, who are prepared to recommend the most suitable methods to be adopted in each case, and to prepare specifications and estimates, not only of the cost of installation, but also of using the different labour-saving appliances.

The apparatus, &c., installed will be kept up-to-date, and added to from time to time.



The Westminster Demonstration Room.

Concert.—A Dublin Corporation Electricity Supply employés' reunion took place on Friday, May 12th, a very enjoyable smoking concert being held in the Grand Restaurant. Mr. Mark Ruddle, city electrical engineer, presided, and with him were Messrs. F. J. Allan, Gilbert Archer, and the other responsible officers of the Electricity Department. The Lord Mayor and Councillor L. G. Sherlock, chairman of the Electricity Supply Committee, wrote regretting their absence from town. A very full and varied programme followed, and it appears to have been very highly appreciated. The stewards were Messrs. W. Melia, R. Donohue, J. Reilly, J. Carey, F. MacNamara, T. Dalton, J. Dalton, J. Kidd and J. Murray. The Concert Committee was composed of Messrs. T. Lurring (chairman) W. Nolan, W. E. Downey, P. Dillon, J. Doran, F. Foster, M. T. Bolger, F. Sheenan, J. Reid, E. J. Davidson (hon. treasurer) and J. MacNamee (hon. secretary).

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A.C. or D.C.?

In answer to your correspondent's question in yesterday's Electrical Review, I should like to offer a few suggestions as to the system most applicable to the works in question.

Assuming that it is intended to generate works supply for power and lighting purposes, I should, if placed in "Inquirer's" position, choose D.C., three-wire, 410 volts between outers for motors and 205 volts between middle wire and each outer for lighting.

My reasons are that there is better control and regulation with D.C. motors, whether applied to cranes or variable-speed machine tools; also D.C. motors have greater efficiency than A.C. at all loads.

Since metal-filament lamps would most likely be installed, it would be better to use D.C., because when the filaments have been in use some 300 hours they appear to be very disjointed and irregular, which I have noticed is far more pronounced on A.C. circuits, and so the life of the lamps is shorter on A.C. than on D.C. circuits.

To increase the working economy of the installation, a battery of accumulators can be fixed and charged at periods of light loads, assisting the generator on peak loads, and thereby doing away with the necessity of spare sets, which would have to be fixed in the case of A.C. plant.

Trusting this short outline will clear "Inquirer's" doubts as to the most economical system to use for general power and lighting purposes in engineering works—

T. W. Brunt.

London, S.E., *May 20th*, 1911.

A Useful Integral.

The correspondence on this subject is somewhat amusing. Mr. Rea's method is identical (though he does not seem to see it) with that of Mr. Dunton; save that the latter deals with a general case and deduces the particular, while Mr. Rea confines himself to the special case. Each integrates by inspection. Further, Mr. Dunton did not state that the integration of $x\sqrt{a^2-x^2}$ "involves a difficult process of double trigonometrical substitution"; the purport of his letter was the exact contrary. What he did say was that the excellent Mr. Saxelby was guilty of that outrage. That is quite horrible. I know nothing of Mr. Saxelby's book; he may be quite as clumsy as most writers on "Practical Mathematics"; but the substitution, $x = a \cos \theta$, which would naturally occur to any mathematician who made any substitution at all, is neither long nor difficult, and leads directly to the result.

W. M. M.

The I.E.E. Wiring Rules.

With reference to your contributor's remarks regarding the above, our reading of several points differs somewhat from his. For instance, it is stated that paragraph 49A "evidently bars out soldered couplings." It certainly bars plain slip sockets, but a soldered socket surely does not come under this heading, but would be considered as a grip joint. Moreover, such a connection conforms to the main requirements of this rule, *i.e.*, "must be electrically and mechanically continuous throughout."

We do not know what sweating system your contributor has had experience with, but with the Kalkos system it is practically an impossibility for solder to penetrate inside the conduit, owing to the accurate fit of all parts. In fact, owing to the careful tinning all fittings receive, a sound joint is obtained by heating the junction even without the use of solder.

Bad workmanship frequently omits many things which are not exposed to view, and no rule will ever prevent this class of work.

With regard to the remarks on paragraph 43, it is perfectly safe to draw in taped-only wire into a system having a really polished inner surface, there being no obstructions met with to cause abrasion. We may say that many hundreds of miles of taped-only wires have been drawn into Kalkos tubes, yet we have no record of any failure of such wire, and as we guarantee to replace failures free of charge, we feel sure that such trouble would have been reported to us.

American practice regarding the recommendation as to the class of cable to be drawn into steel conduit is practically the same as English, inasmuch as the latter provides for weather-proof, &c., or specially braided cable to withstand moisture and rust.

There are, of course, several points of interest in the Institution Rules apart from these, notably Secs. E and F of Rule 49.

Apologising for trespassing on your space to this extent, particularly as your contributor does not express your own opinion of the matter—

The Sun Electrical Co., Ltd.
E. R. Morton, *Kalkos Department.*

London, W.C., *May 23rd*, 1911.

Imperial Telegraphs.

In reproducing my letter—a carbon copy of which I have before me—a further mistake has been made, for the first name should read Neilsen, that being the non-existent name. In the way you have reproduced it, my letter, in this respect, reads as so much nonsense!

Charles Bright.

London, W., *May 22nd*, 1911.

[The confusion which has arisen in this matter appears to be due to the similarity of the names of Mr. Nielsen and Mr. Neilson, which led to the accidental adoption of the hybrid form Neilsen in our report. With the aid of Mr. Bright's letters, and our foot-note last week, the reader, if sufficiently interested, may now solve the puzzle.—Eds. E.R.]

Induction on Telephone Circuits.

Replying to your correspondent "Cheshire's" inquiry in your issue of May 19th, the effect of the power wires running parallel to the telephone wires for a distance of several miles would be to render the service practically useless.

To get over the trouble it will be necessary either to make the telephone lines metallic circuit throughout, and run them on the twist system, or to run them metallic only where they are adjacent to the power wires and insert suitable translators where they branch off.

I would only suggest the latter method if the telephone lines extend for some distance from the branching-off points, and if adopted, it would necessitate changing the instruments from battery to magneto ringing.

If your correspondent will write me direct, I shall be pleased to supply him with full detailed information on the subject, and to advise him as to the most economical method.

W. C. Carter.

58, Oval Road, Erdington,
May 22nd, 1911.

[Several letters have been received too late for insertion.—Eds. E.R.]

Electrical Signalling in Pit Shafts.—At a meeting of the Yorkshire branch of the National Association of Colliery Managers, at Leeds, a paper entitled "A Description of a New Electric Shaft Signal" was read by Mr. Thomas Beach (Hemsworth). The great advantage claimed for the system was that it prevented confusion from two rings running into one another. It ensured a distinct interval between successive rings, thus enabling code signals to be correctly given, and distinctly and accurately received, no matter how rapidly the switches might be operated. Another point was that it was designed to prevent the engineman from starting in response to the banksman's signal to the onsetter. This signal could not be sent to the engine room. The bankaman could only communicate with the engineman by means of a separate light rapper with a totally different sound.

DUST REMOVAL IN COAL MINES.

The problem of effectually dealing by removal or otherwise with coal dust in dry and dusty mines is every whit as important as the question of efficient ventilation. On the worker the physiological effects of dust are certainly not so immediately apparent as are the symptoms of faulty ventilation or gas poisoning, but the effects are none the less certain; and besides this, the danger of explosion due to

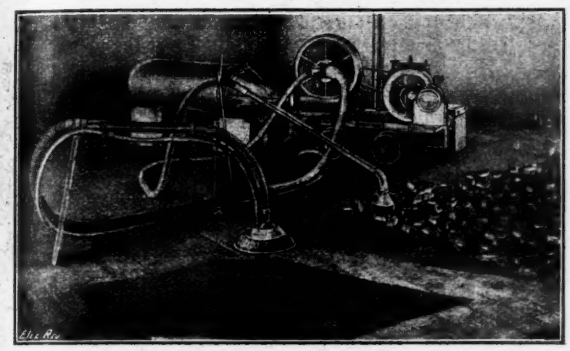


Fig. 1.—Messrs. Mavor & Coulson's Dust Collector.

coal dust is always present. Hence no excuse is needed for emphasising the necessity of effectually dealing with this ever-present danger.

In grappling with the dust problem generally there are two ways open; either remove it entirely or lay it. The old-fashioned housewife who sprinkled slightly moist tea leaves on her carpet before brushing it, was a very good example of the latter, but it is quite unnecessary to urge the vast superiority which the modern vacuum cleaner possesses over such an antiquated method. Similarly the spraying of water on roadways, coal trucks, and conveyer heads may moderate but does not prevent the danger, and the fact that water has such a disintegrating effect on walls and roofs practically places it out of court for general use. Stone-dust sowing and the formation of dust-free zones, though not overcome the difficulties involved in the colliery conditions. It is, of course, perfectly evident that the removal of dust from the rough, uneven and shelving surfaces present in mining practice offers much greater difficulty than where the surfaces are flat and smooth. At the same time it surely was not such an impossible task so to modify a vacuum apparatus as to obtain a new effect, while retaining the old principle of removal by suction.

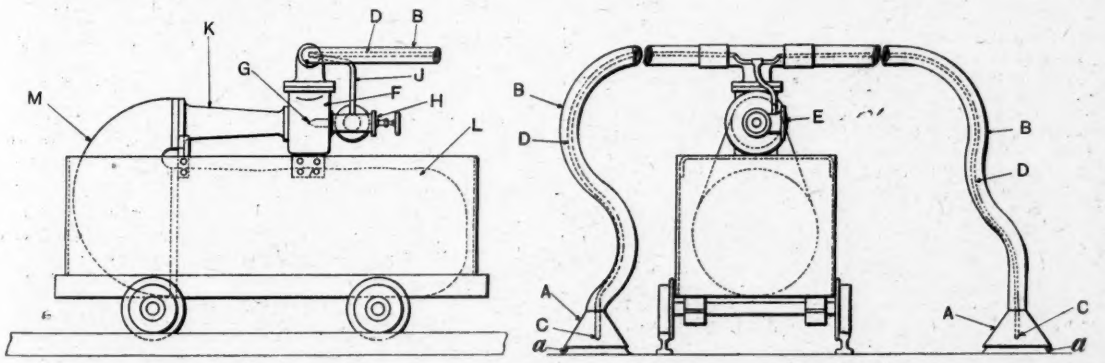
It was our privilege to be present last week at a most interesting demonstration in the works of Messrs. Mavor and Coulson, Ltd., Mile End, Glasgow, of the method which they have devised to effect the positive removal of all dust from the coal mine. The simplicity of the arrangement is only equalled by its effectiveness.

The basic principle of this apparatus is, by means of an air-pressure jet, to create an artificial dust storm inside a conical nozzle connected to a suction pipe. Clearly this gives (*a*) a method of raising the dust out of all irregularities and crevices, and (*b*) of exhausting the dust-laden atmosphere so created. The experimental plant shown in the first illustration is electrically operated, but the apparatus is designed for use either with an electric or compressed-air supply, and thus is of universal application.

It consists essentially of four parts:

1. A conical or bell-shaped mouthpiece attached by bayonet joint to a suction hose. Inside the mouthpiece is a nozzle attached to a pressure-air supply which causes a jet of air to impinge upon the surface to be cleaned, searching out the crevices, and thus raising the dust.
2. A means of obtaining a pressure air jet for disturbing the dust.
3. A means of obtaining air suction in order to withdraw the dust.
4. A filter or separator to retain the dust collected while permitting the escape of the air.

In the case of the electrically-driven and compressed-air operated apparatus parts 1 and 4 are identical, but when electricity is the motive power, an electric motor is used to drive an exhaust fan for the suction and a small pressure fan or blower to supply the dust-disturbing jet. On the experimental apparatus this motor is only taking 1·5 to 2 B.H.P., and the makers claim that the plant in the hands of two boys is quite capable of making 100 lineal yds. of average roadway dust-free per day. The various parts are shown clearly in the accompanying photograph. Of



A, Mouthpiece; *a*, Flexible apron; B, Suction (india-rubber) hose; C, Pressure air disturbing jet; D, Small pipe for pressure air; E, Pressure air supply; F, Air injector; G, Inducing nozzle; H, Regulating valve; J, Air supply to disturbing jet; K, Expanding cone; L, Air filter; M, Steel plate expanding bend.

Fig. 2.—Details of Dust Collector.

efficacious up to a point, can be no real preventative of a dangerous condition. The latter can only be obviated by a complete removal of the cause. That is, in plain language, to stop the wholesale scattering about of coal dust in the first instance, and then to remove and keep on removing the dust which must inevitably be formed in the various coal-winning operations. The suggestion of applying the vacuum cleaner method has been brought up repeatedly at meetings of colliery engineers and managers, and has been ridiculed. It has been pointed out that the conditions of the colliery roadway and the working face are not the conditions of a drawing-room carpet or a staircase runner, and it has been assumed, perhaps rashly, that the ingenuity of man could

course, in actual use, the dust-collecting fabric bag shown distended on the left of the photo would be enclosed in an outer casing carried by a following bogie as indicated in the diagrammatic view (fig. 2) of the compressed-air operated plant. This latter arrangement is one of extreme simplicity, as there is no fan, blower, or other moving part.

A compressed-air supply is taken in at E through a valve H and passed to a nozzle G arranged inside a casing with expanding cones K attached. This jet operates as an air-ejector inducing a current of air inwards through the collecting mouthpiece. The dust disturbing jet is taken off the compressed-air supply as shown at J, and the quantity of air required being quite small is conducted by a flexible tube

D placed within the suction hose-pipe B, to which the mouthpiece A is attached.

In the experiments carried out at Messrs. Mavor & Coulson's works, coal dust was laid on rough flooring in various thicknesses, and an artificial "rough" section shown in the photograph—which was certainly much more severe than anything met with in practice—and on a coke wall not shown. In each case the dust was removed cleanly and expeditiously without any being blown into the atmosphere. In a few minutes almost 10 lb. of coal dust was sucked into the collector bag, this representing about 12½ yards of average roadway.

A further experiment has been made with a layer of dust 1 in. deep; with the same mouthpiece, the dust was collected at the rate of 31 lb. in 5 minutes, being about 250 cb. in. per minute.

Experiments made in France go to show that no dust explosion will take place where the dust is kept under 2 oz. per sq. yd., which means about 80 lb. to the average 100 lineal yards of road. This quantity may gather under normal conditions in from one to two months. With this apparatus doing 100 yd. per day and allowing 20 shifts per month one plant is capable of keeping rather more than 1 mile of roadway dust free. The cost of running is very small, being, as stated, from 1½ to 2 B.H.P. in the electric plant and requiring about 100 cb. ft. of air per minute to work the compressed air ejector type. The plant has not yet been put to use under actual underground conditions, although experiments have been conducted in the works for several months. Arrangements have now, however, been completed for the installation of the plant in a South Wales colliery. The results obtained will be awaited with great interest by all colliery owners and managers, and not less by those of the electrical industry whose interests lie in the direction of colliery electrification.

INDUSTRIAL BANKING.

[CONTRIBUTED.]

UNDOUBTEDLY the ordinary man regards a bank with very little respect, whatever may be his fear of it. The writer's experience of general industry for many years has certainly tended to leave in his mind the impression of banks and bankers as contrivances for forcing poor men into bankruptcy. Nor is he alone in this feeling; it is shared by others with whom the question has been ventilated. Take the case of a small trader, a man held in repute by his fellows, who has conducted a profitable business for some years, is a quiet liver and does not indulge in extraneous extravagancies; let such a man fall into temporary difficulties, by reason of a bad debt or some mishap in a contract, and ten to one his bank will not help him to tide over his troubles, though he may be amply solvent in real values. The only resource left to that man, if a single one of his creditors presses him, is to go into bankruptcy, in order, as it is said, to protect his other creditors. The usual result is that his property is sold for a tenth of its value, a flourishing little business is ruined, and a number of men are thrown out of work, for want of a little financial help to a sound business.

It has been a bad thing for British industry that there have been no industrial banks of the German type; had these existed in Great Britain the malpractices under the cover of the Limited Liability Acts would not have sprung into life, or, if they had, would have been of much less proportions. There can be no two opinions that the obtaining of the public's savings through the channel of the Limited Liability Acts has been most costly. Promoters, as a class, have no interest whatever in the success of the companies they float. They raise, it may be, £200,000, spending perhaps £10,000 in advertising the prospectus. Some patentee gets, perhaps, as much as £25,000 for a worthless patent. The promoting syndicate sells to the company this same patent for £150,000, and leaves the company to manufacture and sell the patented article on the £50,000 of working capital. These are closely the figures of one of the worst cases that have come under the writer's notice.

Now had the article to be made even been good, the probability of success would have been small. Had this same invention been exploited in Germany, some bank would have examined into it through its own experts. If found good, means would have been found to manufacture the article. The patentee would have been allotted a suitable share in the business, and the business would have had a very small, but sufficient, amount of capital on which to pay interest. Had the affair proved a failure, the amount of capital lost would have fallen short of the amount paid in Great Britain to advertise a swindling prospectus.

The investing public in Great Britain have come to regard "Industrials" with great suspicion. They seem to have become aware of the pranks of the promoter, and to have realised that the cost of the works bears no reasonable ratio to the purchase price as per prospectus. In the case mentioned above, the works, of which a great feature was made in the prospectus, was merely an old building in one of London's worst slums, and the value of all its contents was not £300. If there is one thing that strikes an engineer, it is the cool way in which promoters find themselves able to talk of a shoddy, scratched-up cow-shippon of second-hand tools and a wobbly grindstone as "our works."

The abuse of the Limited Liability Acts is notorious. No prospectus ought to be issued which does not carry on some prominent part of the front page in special type some report by an official department in plain language, telling the investor just what it is he is paying for and what profits are being made, and by what steps the affair has reached the stage of public issue. Granted that this would stop nine-tenths of the present promotions, it would make a success of the other tenth.

An inventor once went to a promoter with what may be called, for concealment, a perambulator. He implored the promoter to hold his hand for a time, because he had discovered that his patent perambulator could not hold a baby. The promoter said he did not care a straw; it was none of his business to sell the public a baby carriage; his affair was to draw their money.

And that is the attitude of the average promoter. The honest inventor gets no share at all with him. It is said that in the German system the inventor is also not allowed to ruin his own invention by his foolish egotism. In Britain the promoter makes a point of retaining his valuable services as manager, with the result that, if it is a machine that is to be made, the workshops are soon full of machines in every stage of erection, each one an improvement on the previous one. But no machine ever comes to the working point. Inventors ought to have no voice in the production of their own inventions unless when asked.

No matter how the matter is looked at, it is pitiable, for it is ruining British industry, and the only apparent remedy is the establishment of industrial banks, by which industry should be financed. Under the present system an occasional big success is made. Some investors get the benefit, other investors lose their money or get poor returns. In Germany, the investor puts his money into an industrial bank and receives back a share of all the undertakings financed. All investors get the same average share. That there are abuses even in Germany goes without saying, but these do not reach the discreditable pitch attained in this country. All depends upon the honest management of the banks. Sometimes these have been reckless, and have found themselves too deeply involved in periods of financial stringency.

Germany has made her industrial success out of the fact that her modern industry has been built up on a minimum of capital outlay. This accounts for the good dividends so often declared. These big dividends do not represent the same cash payment per £1,000 of net value of plant that they would in Great Britain. But the German workshop holds £1,000 in tools for each £1,000 spent on tools. The British shop may hold only £500, or less, per £1,000 "spent," the remainder having gone in water.

If our big leaders of industry would see British industry really prosperous, they should devise some system by which new undertakings and good patents could be financed without the present casual methods. There is no way in Great Britain by which the inventor can be sure of having his invention properly exploited. He takes it into the City, and some tout gets hold of it, and if ultimately it is taken up, it is only by the promoter class. Often an inventor reaches his fourth or fifth year before he finds help. It is all so casual, such an example of muddling through. There is no means of finding the right man to go to, for there is no systematic organisation of any industry, much less of the industry of making patents known. Meantime, the patentee keeps on paying the punitive fine by which the country endeavours to dissuade him from the folly of inventing, instead of writing books of which he retains the ownership for many years without payment of any sort.

Yet Great Britain is said to be the leading industrial country. Truly it must be so, or never could it carry on in the face of every obstacle that legislation can devise for strangling it.

A Large American "Emergency" Battery.—The *Railway Electrical Engineer* states that a contract has just been made by the Consolidated Gas, Electric Light and Power Co., of Baltimore, with the Electric Storage Battery Co., of Philadelphia, for the installation of an enormous battery to be used for emergency service. This battery will consist of 152 cells of the "Exide" type, each cell containing 133 plates. Each of the 152 lead-lined wood tanks will measure 4 ft. 2 in. in height, 21¼ in. wide, and 6 ft. 6½ in. long, and will weigh, without plates or electrolyte, 940 lb. The total weight of the entire battery, equipped with plates and electrolyte, when ready for service, will be approximately 1,079,200 lb. This battery, when fully charged, will supply sufficient electricity to light 120,000 25-watt tungsten lamps for one hour, or 240,000 such lamps for 20 minutes, having an output of 4,000 H.P.

These huge emergency or "stand-by" storage batteries are used by the large electric lighting companies in America to provide for unusual demands for current. Recently, in New York City, a heavy snowfall within 10 minutes increased the demand for current on the New York Edison Co.'s system from 100,000 H.P. to 166,000 H.P. In this case the rate of increase in current was so rapid that it was impossible to connect additional generators with sufficient rapidity, and the storage batteries were called upon to meet the emergency, thus saving New York City from darkness.

LEGAL.

Phillips *v.* Costa Rica Electric Light and Traction Co., Ltd.

His Honour Judge Bacon was occupied for several hours at Redruth County Court on 18th inst., in hearing an action in which Richard Phillips, miner, of Carn Brea Village, near Redruth, sued the defendant company for £18 13s., wages.

Plaintiff, with five other miners, contracted to complete the driving of a tunnel in Costa Rica. They contracted for a period of one year from their departure to their arrival in England, or until such time as the work was completed. The claim was for two months' wages, the work having been completed in ten months, and there was a counterclaim for £10 3s. 10d., bonus alleged to have been paid by mistake in Costa Rica.

For plaintiff it was contended that the chairman of the defendant company offered a bonus of £20 in addition if the work was completed within the 12 months, and that this had been paid.

For the defence, it was denied that this bonus was promised, but stated that one of the miners having estimated that the work would be completed in eight months, the chairman promised to pay the men the difference between the wages for that time of the year (two months having been deducted for travelling), which would be £20.

His Honour alluded to a letter sent by the company enclosing the bonus of £20, and decided that the man was entitled to the amount claimed as wages. It was clear that the money mentioned in the counterclaim was paid month by month for expediting the work, and there would be judgment for the plaintiff on this also, with costs.

The Johannesburg Contract Litigation.

Lord Armidale in the Court of Session granted a motion to postpone the diet of proof in the action by the Municipal Council of Johannesburg against D. Stewart & Co. (1902), Ltd., Glasgow. The pursuers sue for £400,000 in respect of alleged breach of contract in connection with the supply of gas and electrical plant, and proof was fixed for early next month. The motion for delay was made on behalf of the defenders, and was strongly opposed by the pursuers. It was explained that it would take counsel a fortnight to read the papers in the case, the hearing of which will last over a fortnight.

The National Telephone Co. *v.* the Postmaster-General

(*Continued from page* 793.)

Major O'Meara, cross-examined by Sir Alfred Cripps, said that the new Avenue Exchange would not supersede the Central Exchange in the way of taking subscribers off the Central Exchange to the new Avenue Exchange. It would simply mean that a certain number of positions would become spare to take up subscribers who were near that exchange.

I am asking you how many subscribers you expect to detach from the Central and connect with the new Avenue Exchange?—It has not been determined yet. At the Central Exchange, Witness said, it was possible to deal with 25,000 pairs of wires. About 19,000 were in use. The number of private wires working through the Central and City Exchanges was just under 100. With regard to the question of fusing, fuses were required, not owing to any fear of the current used in the telephonic line for telephonic purposes, but to guard against larger currents from outside.

Replying to further questions by Sir Alfred Cripps, which were directed to show that the company had not unduly extended its exchanges since the notice of 1901, Witness said he believed Southall and Purley were the only two that had been established since that time.

Counsel asked the witness a number of questions relating to the definition of the "equipment" of an exchange. Would it, for instance, include the testing board of an exchange?—Yes.

Mr. Justice Lawrence: I should have thought everything would have been included in the "equipment" of an exchange.

Sir Alfred Cripps: I don't know whether Major O'Meara would call the wires of an exchange part of its equipment.

Major O'Meara: There are certain wires which would form part of the equipment, because they are attached to the switchboard at the back.

Sir Alfred Cripps: But not the ordinary line wires?—No.

Is everything that you find in an exchange, apart from the wires, part of the equipment?—At a certain point a cable comes into the exchange; that cable has to be attached to some structure, and that structure and everything inward is a part of the equipment.

Mr. Justice Lawrence: And when you say "equipment," you mean to use it in the wider sense of the machinery necessary to communicate along the system?—That is so, my Lord.

Questioning Major O'Meara as to the clauses in the notice of rejection, in which the Post Office claimed the right to reject "iron wires forming part of any telegraphic lines," Counsel asked: Do you really mean to include all iron wires which form part of any telegraphic lines?—All line wires, certainly.

That is another matter. You make a distinction between iron wires in "competitive," and iron wires in "non-competitive" areas. In the one case you say "wires forming part of any telegraphic lines," in the other you say "iron wires forming part of any telegraphic circuit?"—Yes, the iron wires carrying a current in any telegraphic circuit.

But let me put this to you: Are there not numerous iron wires not in a telephonic circuit at all?—That may be so. For instance, the transformer has iron wires around it, and these are not iron wires in the sense of carrying the current as part of the circuit.

Do you suggest that iron wires used for the purposes of attachment as stay wires, &c., should be rejected?—Yes, certainly; if the line is rejected.

Assuming a telegraphic line to which there was no other objection, do you mean to say you would object to it if there were an iron wire stay?—Certainly not; you would not call that a telegraphic line.

His Lordship: So far as I can see, Major O'Meara, the only objection you would have would be to iron wire forming a part of the circuit?—Forming a part of the conducting circuit, my Lord. It does not refer to that which is used mechanically.

Sir Alfred Cripps: Your objection, then, is only to iron wire which actually conveys the current?—Yes.

Where, in practice and in fact, will you find the mechanical iron wires to which you have referred?—In transformers or in induction coils.

Counsel then referred to the clause in the notice of rejection given by the Post Office to the company which specifies "all instruments, wires, and apparatus, which fail to satisfy the tests of audibility" specified in the agreement, and asked: If a particular wire did not satisfy the test of audibility, that would be a question of finding out the fault and setting it right?—It might or it might not.

In answer to other questions, Witness said that notice of rejection did not include a wire in which there might be a merely momentary fault. With reference to another notice of rejection in the case of wires carried over an electric railway, he said that would only refer to the section of the line crossing the railway, but all lines carried along an electric railway in such a manner as to afford any danger of contact would be rejected.

Counsel: Then, your view is that you could throw out a section of a line and leave the rest?—We have to do it frequently ourselves.

With respect to lines along electric railways, Witness said that whether they were overhead or underground, they were subject to the notice of rejection. The Post Office itself, he said, had dispensed with all its lines along electric railways and subways in which electricity was used. The notice which stated that all telephonic lines laid or placed along or across any railway or part of a railway constructed in a tube or tunnel or underground passage did not apply only to electric railways.

His Lordship: It is put in on the ground of access.—Witness said that was so.

Sir A. Cripps: In your notice you say you exclude "all plant not constructed in accordance with the specification and rules"?—Yes, certainly.

Do you want to rule out such plant from the consideration of the Valuation Tribunal?—Certainly, that is the object of the notice.

Have you taken any steps to ascertain what plant, if any, has been so constructed?—I think that is an impossible task at the present time.

Do you mean to say that as engineer-in-chief you have taken no steps to ascertain whether any of the Telephone Co.'s plant will come within this objection?—You have already told the Court the number of officers engaged in carrying out this process.

That is the inventory, and is a different matter?—It is quite impossible to get any idea of what plant is in existence in the way you suggest.

His Lordship: Does it come to this, then, that the notice is given by way of precaution in case any of the plant should not be constructed in accordance with the rules and specification?—Quite so, it identifies the class of article. Witness pointed out that the matter had to be decided by June 30th.

His Lordship: But you cannot decide until you know what it is you have to come to a decision upon?—Witness submitted with respect that that was a matter for the Court.

Sir Alfred Cripps: It is a Chinese puzzle.

Witness, continuing to answer questions in cross-examination, said he had definitely ascertained that there were no cables belonging to the Post Office on the District Railway.

Sir Alfred Cripps: Have you any cables along any other electric railway in London?—No, I do not think so.

In re-examination, Witness said he had ascertained that the Post Office had two cables in the Mersey Tunnel, but they were there before the line was electrified, and they had been allowed to remain there so far. The National Telephone Co. had also two cables there, but they would be accepted, because it was a non-competitive area.

Asked what was the reason of the objection taken to telephone wires across or along railways which were worked by electric power, Witness said that the wires were liable to come into contact with the railway cables, and persons using the telephone wire might receive a dangerous shock. Careless workmen, for instance, on an electric railway might easily cause a contact between the live rail or wire and the telephone wire, with dangerous results.

In answer to his Lordship, Witness said that there had been an increase of 80 per cent. in the development of the London Post Office telephone service since 1902. Since 1905, the number of stations had increased 43 per cent.

Sir James Woodhouse: The Telephone Co., I suppose, has developed at an even greater ratio.

Sir Alfred Cripps: It has doubled in the last eight years.

Sir Rufus Isaacs: That is over the whole of your system.

Sir A. Cripps: Yes.

In answer to further questions by his Lordship, Witness said

that when the Post Office decided to take up any portion of their line, in the case of underground cables, the cable would be taken up and sold for its market value, but it was found to be cheaper to leave the disused conduit in the ground. In the case of the overhead wire the poles would be taken down, and, if nearly new, would be used in connection with some other part of the system; but if the poles were old they would be sold on the ground for what they were worth. In the case of iron wire (which would only be used in telegraphic work), if it were too old it would be buried at the spot where it was taken down; but where it was worth it, or in the case of copper and bronze wire, it was sold for its market value. It was seldom worth while to use the wire again in other parts of the system; rewinding it made it brittle, and after it was put up somewhere else the slightest high wind caused faults, and then there was all the trouble and expense of sending a man out to attend to them.

SIR RUFUS ISAACS then continued his argument upon the contention of the applicants that the notices of objection were invalid. What was contemplated, he said, was that when a notice was given the Court should pronounce an opinion on it.

His LORDSHIP: But if the notice given is so bad that the Court cannot pronounce upon it, what are we to do?

The ATTORNEY-GENERAL: The contention here is that the notice does not sufficiently identify, that it is too vague and not comprehensive. I submit that the notice given is sufficient to be understood by persons dealing with the same subject matter, and they would know to what particular class the notice referred. Of course, if the Court thought some limiting words should be inserted, it had the power to do so.

MR. CRIPPS, in reply, submitted that the Postmaster-General had endeavoured to except from this valuation a large number of things that were included in the notice, and his contention was that if the notice contained things that were bad in accordance with the terms of the notice, then the notice was clearly bad. According to the defendants' contention, whole lines were liable to be condemned where the only difficulty was difficulty of access. His submission was that it was for the defendants to say what part of the lines they intended should be excluded from the valuation. If the arrangement was that the property of the company was to be taken over on tramway terms, then, *prima facie*, all classes of property would be included. There had been introduced, however, a procedure under which the Post Office claimed to exclude certain classes of property from the valuation altogether. It was to make provision for that that the agreement was made. He contended that under it the notices and exceptions served by the Post Office should specify the particular items of plant, &c., which they sought to have excluded from the inventory. If the Post Office was to be entitled to say that all plant not constructed in accordance with the rules set forth in the schedules to the notice would be excluded, and everything not in accordance with the specification would not be taken, then a large quantity of plant before the 1905 agreement might be ruled out of the valuation. He did not desire to raise any technical obstructive objections, but the whole matter must be dealt with as a business proposition. The Postmaster-General was trying to throw the onus on the company of saying what was or was not specified for rejection in the notices that had been served. His contention was that that onus was on the Postmaster-General, and he ought to specifically declare what he would and would not accept. He submitted that the notices as they stood did not give the National Telephone Co. the information they were entitled to, they did not give the valuer the notice which he was entitled to, and they did not give the Court the information to which it was entitled. His first contention was that the notices, as a whole, were bad, but if the Court should come to the conclusion that they were neither good as a whole, nor bad as a whole, then he would submit that they were not separable, and the Court must consider each in order to see what was bad in it. It was not a business notice, and it was not a notice that the company could accept and act on. That, he submitted, was the test. These notices dealt with nearly four millions' worth of plant, and the company must know what part, if any, was to be scrapped.

The ATTORNEY-GENERAL said the contention that the notice might be bad in parts, had taken him by surprise, as he understood the case had been argued on the footing that the notices must be bad as a whole or nothing.

MR. JUSTICE LAWRENCE said that he could not exclude the point, and, if he desired it, he would hear the Attorney-General the following morning.

The Court adjourned early to enable the members to inspect certain of the London exchanges.

On Thursday the ATTORNEY-GENERAL, on the question of whether the Court could find the notices bad as to part, said that the argument put against him was that the notices were not specific. The Court must consider what the effect of the judgment would be in all the various instances. He suggested that they should take the decision of the Court on the London notices. If not, he would be bound to reopen his case on each of them.

MR. JUSTICE LAWRENCE said they would deal with the London notices alone, it being understood that so far as the principle laid down affected the other notices the parties would be bound by it.

SIR RUFUS ISAACS saw no objection to that course if it was left open to him to point out what the effect of the decision would be. They could not confine it to London if they were going to decide a question of principle. He was not suggesting for a moment that the Court should now go through all the notices, and say what was good and what was bad in them. His submission was that Notice No. 2 was sufficiently indicative. In other words, the objection rested on the character of the plant as applied generally, and not to particular exchanges selectively. It was said, therefore, that the Postmaster-General had not been sufficiently specific in the notices. It was said he could not do it merely by reference to a category of plant. His submission was that, once they got the notice confined to a particular area, then the categorical reference to the plant was quite sufficient to indicate what was meant. For instance, where it said "All lines within your area A, which do not form a complete metallic circuit." It was exactly the same to do it by category, and was the same as if they had said "In Area A, Section B, all magneto instruments." He submitted that that was specific both as to area and as to character. It was quite enough to lay down what category of plant was to be refused or accepted.

MR. JUSTICE LAWRENCE asked whether, as a legal point, a person was to be relieved from an agreement because of the difficulty of carrying it out? Sir Rufus said no; all he contended for was that, when there was a reasonable construction and an unreasonable construction, the Court would adopt the reasonable construction. If the Court adopted the construction contended for by the Telephone Co., every part of the plant would have to be labelled and identified if they wanted to have a judgment that would not give rise to subsequent disputes. He submitted that Notice No. 2, when they came to consider it with a view to a specific locality or a specific exchange area, was specific both as to character and to locality, and it would be sufficient to bring home to the minds of the company what it was intended to object to.

At the conclusion of the arguments, MR. JUSTICE LAWRENCE said they would consider their decision.

ANDERSON *v.* CUTTS & HOULT.

THE *Sheffield Daily Telegraph* reports a case heard in the Sheffield County Court, on Friday last, in which T. Scott Anderson, consulting engineer and electro-metallurgist, of Sheffield, claimed £100 damages against Verdon O. Cutts and Ernest Hoult, engineers, of Sheffield, by reason of the wrongful use and publication by them to the prejudice of plaintiff in a booklet entitled "The Electrical Manufacture of Steel in the Verdon Cutts and Hoult Electro-Bessemer Furnace" of information wrongfully collected by the defendant Cutts, whilst in plaintiff's service as clerk, from books, letters, and other documents belonging to plaintiff. In the alternative, damages were claimed for infringement of plaintiff's copyright in books and documents from which material had been taken. An injunction was also asked for.

MR. ELLISON, for plaintiff, said that, after consultation, both sides were agreed that the publication of the pamphlet was one that could not be supported. There was not full agreement as to how exactly the information was first collected on which the pamphlet was written, but it was admitted that it was information obtained in plaintiff's service. Defendants had agreed to give an undertaking that no further publication of the pamphlet should be made, and that the copies which had not been circulated should be destroyed, and had consented to pay £10 damages and costs on Scale "C."

MR. WADDY, for defendants, said that Mr. Cutts, when he left plaintiff, started a competitive business with his old employer, as he was perfectly entitled to do. During the latter part of his employment with plaintiff a large amount of correspondence and technical work was entrusted to Mr. Cutts, and amongst other things he wrote for the purpose of a catalogue an article which afterwards found its way, in a much altered form, into the Verdon Cutts booklet. In those circumstances, Mr. Cutts committed a mistake, and he accepted it quite frankly. He took a wrong view of his legal position. There was no suggestion that there had been anything more than a technical breach of the law of copyright. Defendants willingly gave the undertaking mentioned by Mr. Ellison, but there was nothing, of course, in law to prevent Mr. Cutts putting into the form of a pamphlet, which he might use for purposes of his trade, the results of statements, so long as he did not infringe the copyright of the actual words and phrases of the pamphlet of plaintiff.

Judgment was entered according to the agreement.

Detroit River Tunnel Electrical Equipment.—

The *Railway Electrical Engineer* (Chicago) referring to the paper on the Detroit River Tunnel by Mr. Wilgus, before the Institution of Civil Engineers, mentions that with a view to deciding on the best electrical system to use in the tunnel, general specifications were prepared, giving the physical and traffic conditions to be met, and the tenderers had to submit estimates of both first and annual operating costs. Three proposals were received, which compare as follows:—

	Locomotives for the specified service.			Comparison of costs for entire equipment.	
System.	Weight of each, tons.	No. required.	Aggregate weight, tons.	First cost, %	Annual cost (inc. fixed charges, operation and maintenance), per cent.
Direct current	89½	8	714	100	100
Three-phase	72½	8	578	112	104
Single-phase	53½	16	856	132	120

Our contemporary adds that it is pretty well known that the electrical equipment actually installed cost in the neighbourhood of $1,000,000, and thus a very fair measure of the real dollars and cents advantages of the three systems represented can be obtained. Although the A.C. systems, particularly the single-phase, do not show up well, it must be remembered that the limited extent of the line does not bring out the advantages of A.C. working.

PARLIAMENTARY.

Aberdare Urban District Council Tramways.

On May 15th, 16th, 17th and 18th the Select Committee of the House of Lords, under the chairmanship of the Duke of Bedford, considered this Bill, which, amongst other things, asked for authority to construct tramways, and also to run railless traction tramcars.

Mr. Wedderburn, K.C., Mr. Hutchinson, K.C., and Mr. Tyldesley Jones were for the promoters. Mr. Balfour Browne, K.C., and Mr. H. Lloyd appeared for the Taff Vale Railway; and Mr. Rhys Williams for the Glamorgan County Council.

Mr. Wedderburn, dealing with the tramway portion of the Bill, said the history of tramways was somewhat peculiar because although the need of tramways had never been contested, yet each application had failed on technical grounds. In 1899 that energetic company, the British Electric Traction Co., went before the Light Railway Commissioners, and asked for authority to construct a tramway as a light railway from Trecynon to Abercwmboi, a distance of about 2¾ miles. The application was opposed by the local authority simply on the ground that they wanted the tramways to be in their own hands, and it was on this ground that the application of the company failed. In 1902 the Urban District Council applied for electricity and tramways orders. The first was granted, and the generating station had been erected, but the tramways order was refused owing to the opposition of the frontagers interested in a very narrow portion of the route. In 1905 the local authority came to Parliament with a Bill for various things, including a tramway scheme to cost about £100,000. The tramway scheme was rejected solely on the ground that the financial position of Aberdare did not justify so costly a scheme. The scheme now before the Committee was a more modest one. They proposed a tramway from Trecynon to Aberyman, and four railless traction feeder routes—two to the south—one to the east and one to the north-west. It was impossible to argue that Aberdare should be placed in a less advantageous position as regarded locomotion than such towns as Pontypridd and Merthyr in the same county. The present scheme was to cost £46,996, or half the cost of the 1905 scheme. This was largely due to the smaller cost of the railless trolley system, for the whole scheme was more comprehensive than the 1905 scheme. The opposition of the County Council was directed to the railless traction scheme on about ¾ mile of main road from Aberyman to Abercwmboi. The local authority were not prepared to pay anything to the County Council for the repair of the road. The Taff Vale Railway Co. objected that the scheme would mean unfair competition. As a matter of fact, if the Taff Vale Railway Co. had to pay a penny rate in aid of the tramways it would cost them £11 2s. in the year. [Mr. Lloyd: They pay over £1,000 a year.] They also said that Aberdare was a decaying town, but the Royal Commission had reported that there was enough coal there to keep it going for 70 or 80 years. They further objected that the tramways and railless traction system would interfere with their signalling apparatus, particularly in respect to the proposal to pass over their line by the railless traction cars on the level.

Several local witnesses were called to prove the need of tramway facilities in the district, and Mr. S. Sellon, engineer to the scheme, explained the proposals in the Bill in detail, and expressed the opinion that the scheme would be successful financially. The estimate of the total cost of the tramways was £33,180, and the estimate for providing the equipment for the trackless trolley cars £13,410. Witness was being examined with regard to the effect of the tramways on the signalling apparatus of the Taff Vale Railway, but Mr. Balfour Browne said the petitioners would not press that point.

Further examined, Witness said that the passage of tramways over level crossings on railways was provided for under the Tramways Act. In the case of railless cars, there would be less objection to such crossing because there would be no permanent way.

In answer to Mr. Balfour Browne, Witness said that twice he had given evidence before Parliamentary Committees that tramways in Aberdare would pay, and on both occasions the Bills had been rejected. Since then the population had increased, and the streets had been widened.

Witness was cross-examined at some length on that question, and the amount of traffic expected to be obtained on the railless cars; and in answer to his statement that they expected an average fare of a 1d. per passenger, counsel said that would mean carrying the population of Aberdare 81 times over in the year if they were to get the revenue they expected.

Witness said he did not say the estimate was exactly right, but in other towns they were carrying their population 120 times over.

Mr. Hamilton, manager of the Leeds Corporation Tramways, gave evidence that in his opinion the railless system was admirably adapted for a place like Aberdare.

Mr. Winslow gave evidence of a similar kind, and other evidence having been called, the promoters' case was closed.

Mr. Lloyd, K.C., addressed the Committee for the Taff Vale Railway, and said this was not an ordinary case of a railway opposing a tramway scheme. The proposed tramways were to run absolutely alongside the company's line. The railway company were large ratepayers in a district which was showing a steadily rising rate, and a reduction in the number of railway passengers. He contended that financially the scheme was unsound.

Mr. Beesley, manager of the Taff Vale Railway, gave evidence as to the steady reduction in the number of passengers carried in the district by the company, and said that, in his opinion, if the scheme of tramways were adopted, his company would be very injuriously affected. The motor-car service run in connection with the railway adequately provided for the needs of the district.

Mr. R. Hammond also gave evidence to show that in his view the scheme could not pay.

Mr. Rhys Williams addressed the Committee for the Glamorgan County Council, and suggested that the local authority of Aberdare should contribute to the cost of road maintenence, and also to the widening of the road over which the trolley cars would run.

The Committee decided that the Bill might proceed subject to the local authority contributing a third of the cost of repairing the roads used by the trackless vehicles.

Newcastle Corporation Bill.

A Select Committee of the House of Commons, under the chairmanship of Mr. N. W. Helme, commenced on May 10th the consideration of this Bill, which, among other things, authorises the construction of additional tramways, allows the Corporation to install a system of railless traction, &c. Mr. Freeman, K.C., Mr. H. Lloyd, K.C., and Mr. Simey represented the Corporation, and amongst the opponents were the North-Eastern Railway Co., represented by Mr. Talbot, K.C., and Mr. Charteris; and the Newcastle Electric Supply Co., represented by the Hon. J. P. Fitzgerald, K.C., Mr. Vesey Knox, K.C., and Mr. A. B. Shaw.

Mr. Shortt (chairman of the Improvements Committee) gave evidence in support of that part of the Bill which will enable the Corporation to control street advertisements.

In cross-examination by Mr. Shaw, for the Newcastle Electric Supply Co., Witness said there was an objection to illuminated advertisements, because they attracted large crowds of people, and interfered with the traffic. The Committee, after hearing evidence, rejected the clause.

The Committee afterwards proceeded to deal with the proposal to construct 6 miles of tramways at a cost of £61,000, and to install railless traction on certain routes.

Mr. Councillor Rodgers (chairman of the Tramways Committee) gave evidence, and said that in nine years the Corporation had spent £1,175,000 on tramways. During the nine years they had paid the interest on loans, and also repaid £300,000 of the loans, and had put £95,000 for renewals. In 1908 they paid £12,000 in relief of rates, and were paying another £12,000 this year. Witness proceeded to deal with the proposed extensions, the chief one of which will run partly through the Urban District of Newburn, and expressed the opinion that where tramways had been constructed in the district, they had helped the railway companies.

Mr. E. Hatton, manager of the tramways, also gave evidence in support of the clause.

In cross-examination by Mr. Charteris, Witness said that was not the first time that the Corporation had sought powers to construct lines outside the city area. In fact, they had such powers, although they had not been exercised. The district in which it was proposed to construct the Scotswood to Throckley line was partly served by the North-Eastern Railway Co. The railway fare worked out at 1d. a mile, and the tramways would work out at 1¼ miles for a penny.

A number of local witnesses having been called to prove the necessity for the proposed tramways, the case for the petitioners closed.

Mr. Watson, superintendent of the North-Eastern Railway, was called in opposition to the Bill, and said his company had provided an improved train service for the Newburn District, which was quite sufficient for the needs of the public. The railway fares compared very favourably with those which it was proposed to charge on the tramways. Replying to the Chairman, Witness said that his company had had before them the question of electrifying their line from Scotswood to Newburn. In further cross-examination, Mr. Watson said he was prepared to admit that a tramway service might be useful to the public, despite the fact of the existing railway.

Evidence was given by Mr. Jackson, the engineer to the North-Eastern Railway, who criticised the estimate of the Corporation in regard to the cost of the proposed bridge to be erected to carry the tramway through the railway embankment. The estimate, he said, was only £3,149, but he should put the cost down at £4,700.

Counsel having addressed the Committee in opposition to the scheme, the Chairman said the Committee had decided to approve the preamble of the tramways part of the Bill.

Evidence was then given in support of Clause 3, under which power is sought to provide routes for trolley vehicles.

The Chairman intimated that the Committee were not prepared to grant such powers where they were proposed to be exercised outside the area of the authority.

Mr. Freeman, K.C., for the Corporation, next proceeded to address the Committee on behalf of the clause relating to the running of motor-omnibuses. He said that the promoters had considerably modified that clause, and now only asked for powers to run motor-omnibuses anywhere within the City and along two other routes known as the Westerhope route and the Gosforth Park route.

A large amount of local evidence was tendered in favour of the proposal, after which evidence was called by Mr. Lankester, K.C., for the Northumberland County Council against the scheme, on the ground that the running of the 'buses would increase the cost of the upkeep of the roads. Eventually the Committee decided to strike out the Gosforth Park route, and to allow the Westerhope route.

The adjustment of clauses was then proceeded with, and during

the discussion, Mr. Freeman, K.C., stated that the Corporation had come to an agreement with the Newcastle Electric Supply Co., by which they would take all the current they required for any purposes outside the boundaries of the City—with the exception of the existing tramways in the urban district of Gosforth—from the company at a price which, he believed, would be satisfactory to the public.

Electric Lighting Provisional Order (No. 1) Bill.—On Monday the above Bill came before the Examiner and was ordered to be reported for second reading. The Bill confirms the provisional orders granted by the Board of Trade in respect of the following areas:—

Accrington Corporation.—Extends the order to supply the urban district of Clayton-le-Moors and the parish of Altham, with power of purchase to the Clayton-le-Moors U.D.C. on conditions.

Aldeburgh.—Order to Christy Bros. & Co., of Chelmsford, for the supply of the Borough of Aldeburgh, Suffolk.

Ashford.—Order to the East Kent Electric Supply Co., with respect to the urban district of Ashford, and parts of the rural district of East Ashford.

Blandford Forum.—Order to Messrs. J. & W. Purves of 11, Bedford Circus, Exeter, in respect of the borough of Blandford, Dorset.

Budleigh Salterton.—Order to J. & W. Purves, of Exeter, in respect of the area.

Carlisle.—Order to the Corporation of Carlisle to extend the area to the rural district.

Chichester.—Order to the Chichester Electric Light & Power Co., Ltd., in respect of parts of the rural districts of Westhampnett and Westbourne.

Cirencester.—Order to J. H. Edwards, of 127, Victoria Street, Bristol, in respect of the urban district of Cirencester.

Leominster.—Order to J. H. Edwards, in respect of the borough of Leominster.

Newcastle-on-Tyne.—Order to the Newcastle-on-Tyne Electric Supply Co., in respect of the extension of their area to include that portion of Kenton which is included in the City and County of Newcastle.

Electric Lighting Provisional Order (No. 4) Bill.—This Bill was on Monday passed by the Examiner and referred to the House for second reading. The orders dealt with are as follows:—

High Wycombe.—Order to the High Wycombe Electric Light & Power Co., in respect of West Wycombe and Hughenden.

Harrow.—Order to the Harrow Electric Light & Power Co., in respect of portions of Pinner and Wealdstone.

Sandwich, Deal and Walmer.—Order to the local electric light company.

Sevenoaks.—Order to the U.D.C.

Prussian State Railways and Electricity.—Mr. Chiozza Money asked the President of the Board of Trade (1) if he was aware that the Prussian State Railway Administration was vigorously pursuing a policy of electrifying the Prussian railway system, and, seeing that electric railways in Germany would facilitate the supply of cheap electric power to industry and greatly increase German productive power, what steps he proposed to take to confer similar advantages upon British railway traffic and British industry; and (2) if, in view of the importance of the subject, he would present to the House a translation of the report to the Prussian Diet by the State Railway Administration upon the economy and advantages of electric traction for long-distance railway traffic. Mr. Buxton replied that he was aware that it was proposed to equip certain sections of main line on the Prussian State Railways for electric traction. He did not think that we had, so far, any reason to be disappointed with the progress of electric traction in this country, and the Railways (Electric Power) Act, 1903, provided facilities for its introduction on railways. But Parliament had not been inclined to encourage the supply of energy by a railway company to other industries.

East Kent Electric Power Bill.—The House of Lords have dispensed with the order regarding the deposit of Bills so as to allow the East Kent Electric Power Bill to be introduced. The object of the Bill is to transfer to the South-East Kent Electric Power Co., Ltd., certain of the powers of the Kent Electric Power Co.

Scotch Electric Lighting Orders.—Electric Lighting Provisional Order (No 3) was on Monday before the Examiner and was ordered for second reading. It confirms Board of Trade orders in respect of Alloa, granted to the local authority; of Fife, granted to the Fife Tramway, Lighting & Power Co.; and of Grangemouth, granted to the local authority.

Metropolitan Electric Tramways Bill.—This Bill came before Sir Luke White's Committee of the House of Commons on May 18th and the preamble was declared proved. The principal power sought in the Bill was the making of a new bridge over the River Lea at Tottenham, over which tramways will be laid to join up the company's system between Essex and Middlesex.

Metropolitan Railway Co.—On May 18th the Bill promoted by the Metropolitan Railway Co., for the construction of a new station at Mount Pleasant, for widening of the line at certain points, and for powers with regard to its capital, came before Mr. Emmott's Committee on Unopposed Bills, and the preamble having been formally proved the Bill was ordered to be reported for third reading.

Third Readings.—In the House of Lords, on May 16th, the London United Tramways Bill passed its third reading. On 23rd inst. the Middlesbrough, Stockton and Thornaby Tramways Bill, and the London Electric Railway Bill, passed their third reading.

In the House of Commons, on May 19th, the South Lancashire Tramways Bill was read a third time.

Macclesfield and District Railless Traction and Electricity Supply Bill.—The Standing Orders Committee of the House of Lords has decided that standing orders may be dispensed with in the case of the additional provision for this Bill, and that the parties be allowed to proceed.

Receiver Appointed.—J. G. Childs & Co., Ltd., Willesden Green.—Mr. H. W. Freshwater (Messrs. A. C. Palmer and Co., 7 and 8, Railway Approach, London Bridge, S.E.) has been appointed Receiver on behalf of the debenture-holders.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Boiler-Feed.

The accompanying illustration shows a device for controlling the level of the water in a boiler, of which the whole of the moving parts are external to the boiler shell; it is constructed by Messrs. Schiff & Stern, of Leipzig, and was described in a recent issue of the *Génie Civil*.

The valve v, which is inserted in the feed pipe, is operated by lever h, which turns about an axis w and is provided with a counter-weight k. The other end of the lever carries a light cylinder t, open at the top, which moves freely inside the box g. The latter is

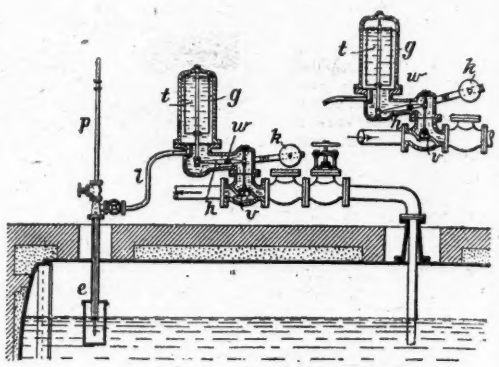


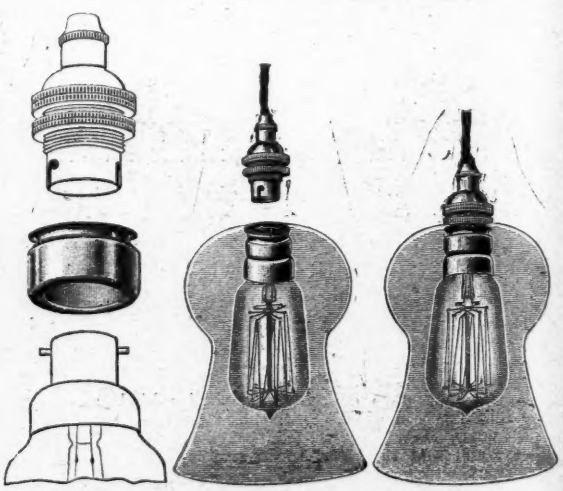
Fig. 1.—Automatic Boiler Feed-water Regulator.

in communication with the boiler by way of the tubes l and p, the end of which is cut obliquely and opens in a rose e, at the normal water level.

The apparatus is shown with the end of the tube p drowned; in this case the boiler water fills the box g and the cylinder t, and the weight of the latter in water is insufficient to overcome the counter-weight k, which closes the valve v. When the level of the water falls and the end of the pipe p is uncovered, the water in g runs out and is replaced by steam, but the cylinder t remains full of water, and by its weight opens the valve v, admitting feed water, as shown in the small view inset. When the water level is restored and the end of the pipe p covered, the steam contained in g condenses, water re-enters, and the valve is closed. The moving parts being in an accessible position, and removed from risk of incrustation or corrosion, it is claimed that the device is not likely to get out of order.

Aston Shade-Fixing and Lamp-Locking Device.

Messrs. Veritys, Ltd., of Aston, have introduced a device for facilitating the fixing of lamp-shades. A slotted ring is slipped over the cap of the M.F. lamp and rests on the enlarged shoulder



Figs. 2, 3 and 4.—Aston Shade-Fixer.

of the latter. Lamp and ring are inserted in the shade, and the lamp forced into the holder in the usual way; the shade ring, which is now outside the shade, is screwed down, fixing the shade and locking the lamp. Our three figures show the device in use.

New Bennis Stoker Gear.

Messrs. Ed. Bennis & Co., Ltd., of 28, Victoria Street, S.W., whose connection with mechanical stoking appliances is well known to our readers, have recently introduced a patent balanced self-oiling detachable double shovel-arm gear, a general view of which is given in fig. 5, and a diagram in fig. 6. Reference to the latter will show the four-armed tappet which, as it revolves, forces back the tripper against the pressure of the spring in the pneumatic cylinder.

The tripper is attached to one side of the shovel arm carrying the shovel, and carries the latter back with it until the tappet disengages, when, under the controlling spring, the shovel is forced rapidly forwards, scattering coal over the furnace. The shovel-arm thrower is now carried on a steel shaft with outside bearings, and the shovel-arm is bent round and carried up both sides of the box: the shovel, shovel-arm, and shovel-arm shaft form practically a rigid rectangle, with one side bent to form the nose of the distributing shovel.

The tripper is a separate casting, bolted to a shovel-arm shaft ear and the shovel-arm; the tappet which has been redesigned has

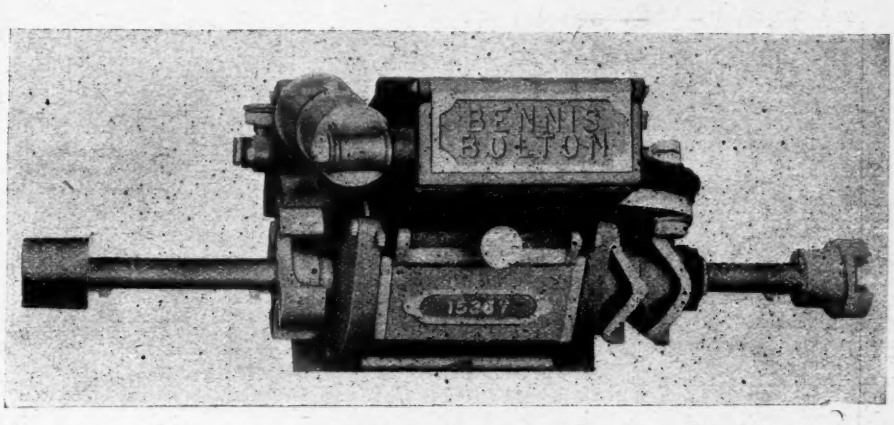


Fig. 5.—New Bennis Machine Stoker.

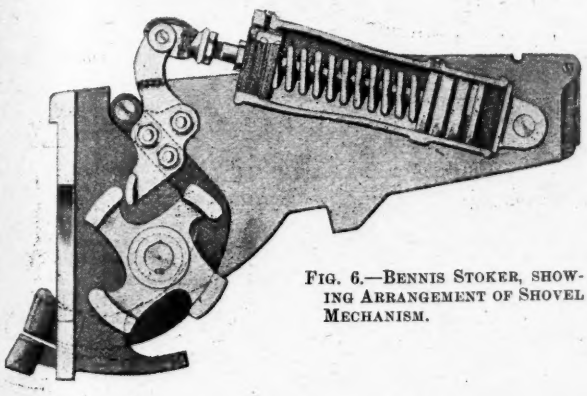


Fig. 6.—Bennis Stoker, showing Arrangement of Shovel Mechanism.

four varying lifts; and the pneumatic gear has been improved. Messrs. Bennis have aimed at producing a simple mechanism, in which the various parts are immediately detachable and the shovel can be removed from its shaft without taking out the latter.

White Controller Fingers.

The Traction Supplies Co., Ltd., of Sunderland, who have made quite a speciality in patent controller fingers with reversible and renewable contacts, for controllers of all kinds, have recently

Fig. 7.

Fig. 8.

Fig. 9.

added large-pattern contacts for railway fingers, shown in fig. 7, and extra heavy contacts for use in rolling-mill controllers, as shown in fig. 8. Both of these are interchangeable with the standard pattern.

A Dick-Kerr pattern finger with single renewable tip, as used on the Liverpool Overhead Railway (fig. 9), has also been added to the list.

These fingers, owing to the tip being reversible and renewable, have proved very popular with the leading tramways throughout the country, also with the engineering community on the N.E. coast.

The "Ampall."

Under this title Mr. R. W. Paul, of New Southgate, N., is introducing an ingenious instrument to serve a variety of purposes. It consists of a Unipivot millivoltmeter reading 1,000 on the scale for 2 millivolts, a contact block with potential points spaced to give a drop of 2 mv. on a copper conductor carrying 1,000 amperes per square inch, and flexible leads with plugs at the ends for connecting these points to the millivoltmeter. The block is made so that it can conveniently be strapped on a conductor of any size from 0·1 sq. in. upwards, and thus the current density in the conductor is at once indicated by the scale reading, which multiplied by the cross-section of the conductor gives the current in amperes; to facilitate this process, a circular slide rule is provided with the instrument, which gives the result at a glance. The utility of the instrument for measuring direct currents of any value, without

Fig. 10.—The "Ampall."

limit, is obvious; we give an illustration of it (fig. 11) in use on one of the heavy copper rod connections of a large battery, and it can similarly be applied to measure the current in bus-bars, cables, electric furnace leads, &c., without breaking the circuit. To allow approximately for temperature rise, the potential points are adjusted on the assumption that the copper rod is a few degrees above the temperature of the surroundings, and the moving coil is of copper. It may be added that, with a few extra contact blocks and a small switch, a single Unipivot instrument can thus be used as a switchboard ammeter for a number of separate circuits.

The "Ampall" can also be used for measuring the resistance of switch and fuse contacts, joints, arc lamp carbons, &c. (fig. 12); for this purpose two steel points with handles are provided, into which the

flexible leads can be plugged, and a copper resistance of 20 microhms is added for use as a standard; all these parts are shown in fig. 10.

Connecting the resistance in series with the thing to be tested, deflections are taken by means of the steel points, successively on the standard and on the unknown resistance, when the ratio of the

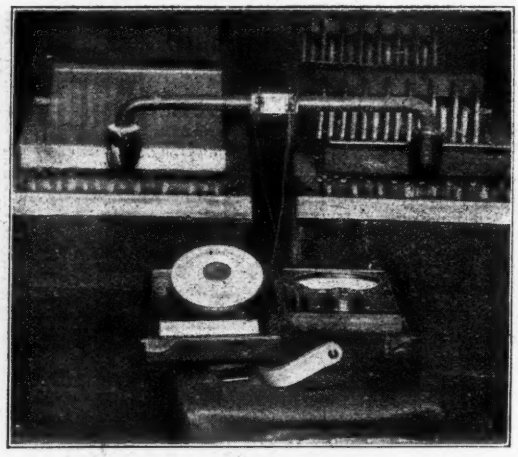


FIG. 11.—THE AMPALL USED FOR MEASURING CURRENT IN A BATTERY CONNECTOR.

deflections multiplied by the resistance of the standard gives the unknown resistance. The voltage drop at switch contacts, &c., can, of course, be read off at once on applying the steel points to the parts to be tested. When the standard resistance is left in circuit

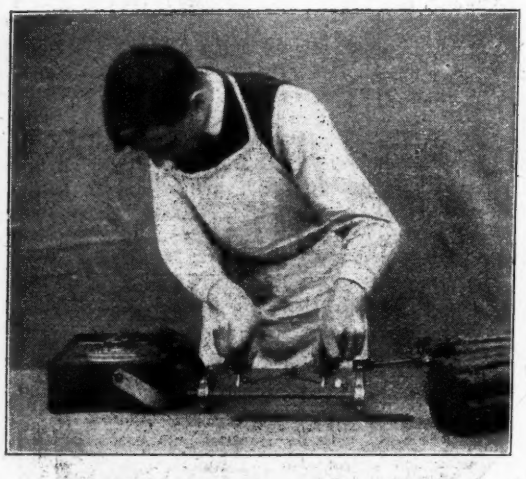


FIG. 12.—THE AMPALL USED FOR MEASURING THE RESISTANCE OF CARBONS.

as a shunt to the instrument, the Ampall becomes a moving-coil ammeter reading up to 150 amperes, the deflection being divided by 10.

The resistance of the instrument is 10 ohms; an adapter plug containing 90 ohms resistance has been added, which can be used whenever the deflection is too great without it, the scale reading being then multiplied by 10.

Electrostatic Voltmeter.

MESSRS. P. VILLARD and H. ABRAHAM have devised a novel type of direct-reading high-pressure voltmeter, an account of which is given in the *Revue Industrielle*. The instrument resembles an ordinary voltmeter, but is mounted on a tall insulating column; the scale is graduated from 5 to 150 or even 300 kilovolts. The mechanism is of the simplest nature, being based upon electrostatic action. The curious feature of the instrument is that only one pole of the circuit under test is connected to it. The other pole is joined to a large disk, similarly mounted on an insulating column at a distance of 10 or 20 cm. from one side of the voltmeter. A small disk, practically forming a movable portion of the wall of the instrument, is more or less attracted by the charge on the large external disk, as in the attracted-disk electrometer, and gives corresponding indications on the graduated scale. When great precision is desired, a similar large disk is attached to the case of the voltmeter, facing the external disk, and acting as a guard-ring. If one pole of the circuit is earthed, the external disk may be dispensed with, the walls of the room serving the same purpose.

BUSINESS NOTES.

Engineering Developments in Chile.—With reference to the scheme for the electrification of Chilean railways, which has several times been mentioned in our pages, it is interesting to note the comments made concerning this matter by the Special Commissioner of the *Engineer* in South America. In the last issue of that journal, in his very useful series on "The Progress of Engineering in South and Central America," he says:—"There is talk of electrifying two of the existing lines of railway at immense cost, and, so far as one can see, without any pressing necessity. . . ." "The Government will shortly be considering tenders for the electrification of certain of the State Railways, among them those from Valparaiso to Santiago, from Las Vehas to Los Andes, and from other points later on. The contract will also be for the supply of the locomotives and other necessary equipment, the Government buying the motive power at a fixed price per kilowatt, and guaranteeing a minimum consumption. I may here add that the entire project of electrifying the State Railways is most unpopular, and so strong is the feeling against it that in all probability public opinion will eventually kill the scheme."

Other matters covered in the course of this very interesting article include the recent successes of British engineering and contracting firms in securing against foreign competition (notwithstanding banking support) very large contracts, the punctiliously honourable dealings of the Government with foreigners, and the necessity for Chile to "go slow"—completing one undertaking in part before plunging into another. The reason for this advice lies in the very large number of costly public works undertakings which are being proceeded with simultaneously. Another point of interest is that the Government in some of its big railroad contracts offers a bonus of £3,000 for every month that the work is completed short of the specified time, but imposes a penalty of £6,000 per month for excess time occupied beyond the agreed period for completion. The Government has a predilection for British contracting firms in these large undertakings, because they generally "fulfil their part of the contract 'like gentlemen'"—an experience which has not always been recorded in dealings with other foreigners.

From Grave to Gay.—At the funeral of the late King of Siam recently, the entire illumination effect was produced by means of Osram lamps representing in the aggregate more than 100,000 C.P. These lamps are also to serve for the entire illumination of the French ironclad *Vérité*, upon which the President of the French Republic shortly starts upon his voyage.

Catalogues and Lists.—THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C.—New publication (20 pages), No. K 20, containing illustrated descriptions of their Witton-Kramer portable tools, including the "Runthru" electric drilling machines (breast and feed-screw types), electric grinders, blowers, grinding, polishing and buffing machines, transportable electric drilling, grinding and tube-cleaning outfits, electric coal-drilling machines, Witton-Kramer flexible shafts, magnetic drill posts and drill presses. Sizes, code-words and prices are clearly set out in tabular form.

Twenty-eight-page catalogue just issued, devoted to "Witton" switchboards. General information, explanatory diagrams, specimen estimates and clearly arranged prices, are some of its noteworthy contents, in addition to fully and well illustrated descriptions of complete boards for all standard requirements, also a number of individual panels. The user can thus obtain with facility either a standard complete board or several standard panels for his own assembling with instruments and gear shown in other sections of the G.E.C. catalogues. Small generator boards, main distribution boards, distribution, switch and fuseboards, generator and accumulator switchboards, garage switchboards, generator, booster, feeder, traction and other panels, feeder pillars and accessories—all of these, and some other lines, are covered.

MESSRS. FYFE, WILSON & CO., 149, Bath Street, Glasgow.—16-page pamphlet (No. 112) containing full description of their Kelvin petrol and paraffin-driven electric generating sets for the lighting of country houses, hotels, shooting lodges, coast houses, &c. Particulars and prices are specified for 50-light 25-volt sets, also 50, 100, 150, 200 and 300 50-volt sets, and 300-light 100-volt sets. Admirable half-tone pictures appear of 3, 8 and 16-KW. plants.

THE BENJAMIN ELECTRIC, LTD., 1A, Rosebery Avenue, London, E.C.—A priced leaflet has been issued relating to their Benjamin weather-proof lampholders for mounting on strips, borders, &c., for Coronation illumination and wooden sign purposes. Moisture is prevented from entering the lampholder by means of a rubber ring. For interior lighting, the holders can be supplied without the ring.

MESSRS. METALITE, LTD., Horsell Road, Highbury, London, N.—Illustrated circulars, intimating on their June, 1910, price list that they are the successors of the Bryant Trading Syndicate, and indicating reductions made in the prices of 100-C.P. lamps since that date.

MESSRS. ALLDAYS AND ONIONS PNEUMATIC ENGINEERING CO., LTD., Birmingham.—Illustrated leaflet describing and giving prices of their "Sertus" continuous-current ball-bearing propellor fans. Prices are given for fans ranging from 12 in. to 60 in. diameter.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—"Coronation List No. 2,177," consists of eight pages of illustrations of emblematic devices, crowns, letters, monograms, B.T.-H. illumination strip, carbon and metallic-filament lamps, and other lines for use in the approaching celebrations. Prices are given of all the designs and devices. "Surplus List No. 170" just issued gives

tabulated candle-powers, voltages, bulb shape, and price particulars of a surplus stock of carbon-filament lamps, also "Meridian" and Gem-metallised carbon lamps, which are being offered at very low rates.

Messrs. Wright & Wood, Ltd., Century Works, Halifax.—Two new price sheets, No. 31, tabulating powers, prices, shipping particulars, &c., of their continuous-current motors and dynamos from ½ to 100 h.p., and No. 32 fully tabulating similar particulars of two and three-phase induction motors (4, 6, 8, 10 and 12 poles), for 60, 50, 40 and 25 cycles. In both cases prices have been reduced owing to the large quantities manufactured, and, we understand, owing to improvements in design. Copies of the lists can be obtained on application.

The British Aluminium Co., Ltd., 109, Queen Victoria Street London, E.C.—Leaflet No. 112, giving instructions for polishing, satin finishing and frosting aluminium.

The Foster Engineering Co., Ltd., Morden Road, Wimbledon. —Leaflet giving a few particulars, with illustrations, of their large capacity power transformers, of which they make a speciality, including both polyphase and three-phase, high and low tension.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Sixteen-page pamphlet containing illustrated descriptions, and prices very clearly indicated in red, of their galvanic batteries—Silvertown Leclanchés, firing batteries testing batteries, medical batteries, Poggendorf, Bunsen, Minotti, Grove and Daniell batteries, also the Silvertown Bleech-Love primary battery. A second 16-page publication equally clearly sets out the prices of gutta-percha, india-rubber, silk and cotton-covered wires, also jointing tools and materials.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Sixteen-page catalogue (No. 533), containing a number of illustrations accompanied by brief descriptive notes and prices of the Siemens electrical water-level signalling apparatus which have been specially designed for the purpose of indicating the water level of reservoirs, wells, &c., at distant points by means of indicating instruments, with or without recording devices, or by electric bells. Diagrams of connections are included.

The Hoffmann Manufacturing Co., Ltd., Chelmsford.—Circular 801, containing eight pages of illustrated matter regarding the Hoffmann ball bearings applied to machine tools, lathes, drilling, milling, planing and turning machines being shown. Copies of the list may be had on application.

Messrs. Hindle, Maitland & Co., 100, Deansgate, Manchester. —Illustrated pamphlet describing their patent electric press for packing trades and pressing industries. The press is directly actuated by electric power, the requisite pressure being obtained by means of motor-driven reduction gear and a special combination of flexible steel wire rope and frictionless sheaves.

Allgemeine Elektricitäts-Gesellschaft, Berlin. — Pamphlets relating to the A.E.G. turbo-compressors, which are very fully described, iron resistances for car-lighting, motor-generators of all sizes, "intensive" white light arc lamps, and small transformers.

Mr. R. W. Paul, New Southgate, London, N.—Abridged list of electrical standard, laboratory and portable instruments, including resistances and bridges, moving-coil instruments, galvanometers, alternating-current instruments, pyrometers, &c.

Foreign Electrical Enterprise in Argentina.—The *Review of the River Plate* reports that the syndicate represented by Mr. Herlitzka, and in which the French Bank of the River Plate is also interested, had obtained a controlling interest in the Anglo-Argentine Electricity Co. "They have acquired during the past few days shares amounting to $550,000, which is more than half the capital. We understand that they paid $125 per share. The whole business was carried through without the Bolsa getting wind of it in time to operate. This syndicate is also interested in Mendoza, Salta, Cordoba, La Plata, San Fernando, and other stations. In course of time we may expect to see all these interests amalgamated."

Bankruptcy Proceedings.—Alphonse Christian Adolphe Wampach, electrical engineer, Formby Lodge, Seabrook Road, Hythe.—Mr. Deputy Registrar F. M. Furley held a sitting at the Guildhall, Canterbury, last week for the public examination of the above debtor. The liabilities were put at £1,391, and the assets were estimated to produce £48, leaving a deficiency of £1,342. The debtor stated that his personal expenses had largely exceeded the amount of his income, but he had been assisted from time to time by his father. Last August his father paid the whole of his (debtor's) then existing liabilities with the exception of about £48 due to the execution creditor. Debtor owed his father nearly £1,000, and with the exception of this amount and the £48 due to the execution creditor, all the debts now appearing in the statement of affairs had been incurred during the past 12 months. The advances his father had made amounted to about £150 to £200 a year on an average. He admitted that he had lived in excess of his income, probably at the rate of £300 to £350, whereas his income had only been £150. He had, however, made £70 or £80 a year as an insurance agent, which would bring his income up to £230. The debtor stated that he had been on the wrong side for the past 10 or 11 years. The case was declared closed.

William Henry Illingworth, Halifax and Leeds.—The public examination was held at Halifax on Friday last, when the debtor stated that he had traded as the Yorkshire Metal-Filament Lamp Co. since October, 1910. He had estimated a surplus of £22 5s. 10d. over his liabilities, but the Official Receiver said that when liabilities had been included that had been omitted there would be a large deficiency. After the debtor had been examined at some length, the Official Receiver expressed the opinion that the debtor's losses had been brought about by his want of business ability and his bad management. Debtor admitted that he had done a little betting, but not for himself. A chartered accountant had gone into the accounts of the firm, of which the debtor was formerly a partner, and he found that he owed the firm £141 odd instead of the firm being indebted to him. The examination was ordered to stand adjourned.

W. H. Steed, electrical engineer and motor dealer, Altrincham.—The liabilities are £421 and the assets £279. At the Manchester County Court, the Official Receiver stated that there was not a single serious complaint; it was not once in a hundred cases that an Official Receiver could make a clear report such as this. His Honour had power to grant an immediate discharge, and if that course were taken he (the Receiver) would not for a moment argue against it, although a suggestion had been made that the debtor should find £13 more and bring the dividend up to 10s. in the pound. The report being favourable, his Honour said he would grant an immediate discharge.

E. Surtees, electrician, South Shields.—First and final dividend of 2s. 6½d. in the £, payable May 30th. Official Receiver, 30, Mosley Street, Newcastle-on-Tyne.

Book Notices.—The *Northampton Gazette* is the name of the official publication of the Past Day-Students' Association and the Engineering Society of the Northampton Institute, of which the first joint issue has been sent to us. Dr. Walmsley, in a short preface, which happily is not called a "foreword," addresses a cordial greeting to the members, and the contents include articles on electrochemistry, the history of the Engineering Society, the engineering industry in North America, and a variety of other interesting topics, making a very creditable start.

"Solders." By A. H. Hiorns. Reprinted from the *Birmingham Engineering and Mining Journal*.—This reprint of an excellent article on all kinds of solders has been sent us by Messrs. Bi-Metals, Ltd., of 80A, Southwark Street, S.E., who will also send any of our readers a copy on receipt of a post-card.

The Cambridge University Press is about to issue *Electricity in Locomotion*, by A. G. Whyte, B.Sc., dealing with the application of electricity to locomotion, the present condition of affairs and the developments which may be looked for in the near future.

"*Journal* of the Association of Teachers in Technical Institutions." Vol. IV, No. 2, April, 1911. Liverpool: The Northern Publishing Co., Ltd. Price 1s. 2d. post free.

"Das Moderne Installationsmaterial unter dem Gesichtspunkte der Gefahrlosigkeit, Bequemlichkeit und Sparsamkeit." By Ober-Ingenieur A. Hermanni. Lecture delivered on February 8th before the staff of the A.E.G. Berlin: From the Allgemeine Elektricitäts-Gesellschaft.

"Annual Report of the Smithsonian Institute, 1909." Washington: Government Printing Office.

"Die Schutzvorrichtungen der Starkstromtechnik gegen Atmosphärische Entladungen und Uberspannungen." By Dr. Gustav Benischke. 1911. Brunswick: Vieweg & Son. Price M. 3.50.

"Water Wireless Telegraphy." By Habibur Rahman Khan. 1911. Allahabad: From the author.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 5. May, 1911. New York: From the Institute.

"Revue d'Electricité." Vol. XXVII, No. 4. April, 1911. Brussels: Emile Bruylant. Price 1 fr. 75 c.

"Atti della Associazione Elettrotechnica Italiana." April, 1911. Milan: Stucchi, Ceretti e C.

"The Modern Bioscope Operator." 1911. London: Ganes, Ltd. Price 3s. 9d. post free.

Motor-driven Slab-Handling Machine.—Messrs. Babcock & Wilcox, Ltd., who now include among their manufactures steel works cranes and charging machinery, have just received an order for a slab-handling and charging machine of 5-ton capacity from Messrs. James Dunlop & Co., Calderbank Steel Works, Scotland. The machine is electrically driven in all its motions, and is designed, with several important improvements, to secure rapid handling of the slabs. It is expected that this machine will increase the output of the rolling mills and reduce the present labour costs at Calderbank.

Coronation Illuminations.—Messrs. Seymour & Co., of 1 and 7, Ellis Street, Sloane Street, S.W., have laid themselves out for electrical illumination and decorative work in connection with the Coronation. We paid a visit to their premises the other day, and witnessed the various operations leading up to the complete electrically-illuminated sign or shield or crown. A special staff is engaged designing, shaping, painting and wiring. Floral decorations painted on wooden shapes with frosted or coloured lamps fixed on the ordinary batten principle, instead of strip, are on exhibition, and we believe they will be found to be very effective. The devices are so arranged that they can be connected to the existing house supply with a minimum of trouble, a point which may appeal to consumers who are not likely to use sufficient current to make a separate reduced rate supply worth troubling about. Messrs. Seymour place their collection of completed crowns, shields, letters, centre pieces, artificial vases, and shields with appropriate naval views, open to the inspection of the electrical trade and their clients. The exterior of their premises is adorned by transparencies of the King and Queen, on glass. The firm have in hand the illumination of the exterior of the works of the Chelsea Electricity Supply Co., Ltd., with some 300 lights.

For Sale.—Mr. H. Simpson will, on Thursday, June 1st, sell by auction the plant, machinery, stock, &c., of the Mitcham Electric Fan Co., Ltd., and the Dynamic Syndicate, Ltd. See our advertisement pages to-day.

Dissolutions and Liquidations.—Tasker Sons & Co., Ltd., Sheffield.—Creditors must send in the usual particulars to the liquidators (Messrs. G. S. Greening and T. G. Shuttleworth) by June 14th.

The Australian Electrical Co., Ltd.—This company is winding-up voluntarily with Mr. E. Pears, 20, Copthall Avenue, E.C., as liquidator. A meeting of creditors is called for May 29th. Creditors must send the usual particulars to the liquidator by June 20th.

Beckett, Charles & Co., motor accessory factors and electricians, 57A, Renshaw Street, Liverpool.—Messrs. G. A. Beckett and C. C. Aronsberg have dissolved partnership. Mr. Aronsberg attends to debts.

Private Meeting.—J. P. Beckett & Co., electrical engineers, Victoria Street, and Cleethorpes Road, Grimsby.—The creditors of the above were called together last week, when a statement of affairs was submitted which disclosed liabilities amounting to £345. The indebtedness to the trade was £338, and the balance of £7 was in respect of cash claims. The net assets were £525, and a surplus was disclosed of £179. It was reported that the debtor had been in business for some years. He was joined in partnership four years ago by a Mr. Trolley, but the partnership only lasted about six months and was then dissolved. The dissolution of the partnership was duly gazetted, and since that time the debtor had traded alone. The branch shop at Cleethorpes Road was opened by the debtor last October. He estimated that his turnover had been in the neighbourhood of £1,000 per annum, while his drawings had averaged £2 weekly. He was a single man living in apartments, and was possessed of no household furniture or life policy. In consequence of proceedings having been commenced by one creditor, a deed of assignment had already been executed to Mr. Oscar Berry, chartered accountant, Monument Square, E.C. The debtor made an offer to pay his liabilities in full, by three equal instalments at two, four and six months. It was stated that the debtor could offer no security except the assignment he had already made, and the creditors decided that the offer should be accepted. It was decided to leave the matter in the hands of Mr. Berry, as he had an office in Grimsby. A committee of the principal creditors was also elected.

Trade Announcements. — The Phœnix Electric Heating Co., electric cooking and heating apparatus manufacturers, 17, Morwell Street, Tottenham Court Road, London, W.C.—Messrs. S. A. Sillem, F. A. Donnison and W. Sillem having transferred their interests in this company to Mr. S. Douglas Cox, who has held the position of manager for the past three years, he will continue to conduct the business at the same address, under the existing title.

Messrs. Spencer, Chapman & Messell, Ltd., of Mark Lane, E.C., notify that their telephone number is now Avenue 1588.

The Rees Roturbo Manufacturing Co., Ltd., of Wolverhampton, announce that for greater facility in dealing with London, South of England, and foreign business, they have opened a branch office at Norfolk House, Victoria Embankment (opposite Temple Station), London, W.C. Telegrams, "Hydroturbo"; telephone, "City, 9156."

Coronation Illuminations at Piccadilly Hotel.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston Lane, have obtained the contract for a complete scheme of Coronation illuminations and decorations for the Piccadilly Hotel. In accordance with their usual custom, they are sub-letting the actual contracting, and in this instance the work has been given to Messrs. Duncan Watson & Co.

LIGHTING and POWER NOTES.

Accrington.—The accounts of the electricity department for the year ended March 31st show a gross income of £17,310 and gross expenditure of £8,962, leaving a revenue surplus balance of £8,348. The charges for redemption of debt, &c., amount to £5,647, bringing the £8,348 down to £2,701. This sum has been appropriated as follows: Rate aid, £550; to capital expenditure on meters, motors, &c., £1,332, leaving a balance in hand of £774. The sum provided by the rates for deficiencies in former years, and not yet repaid, is £6,000. During the year £2,591 was taken out of the depreciation fund and expended in the purchase of new and second-hand machinery, land and premises for extensions, and the cost of provisional orders. The credit balance at the end of the year was £503.

Argentina.—The city of Buenos Ayres has had electric lighting in general use for a matter of some 15 years or more, and has also had a public lighting department. From time to time efforts have been made to introduce rules and regulations for such installations, but nothing has been done by the authorities, the foreign insurance companies being the only ones who have issued rules, and these rules are now general throughout the country. A proposition has now been brought forward by the City Councillors to the effect that the Public Lighting Department should inspect all installations and approve of same before current is turned on. It is also proposed that all existing installations should be inspected. The cost of inspections is to be met by a charge of 1 per cent. on the cost of installations or modifications.—*The Review of the River Plate.*

Australia.—Goulburn (N.S.W.) is seeking statutory powers to install a system of electric lighting throughout the city. Mr. Donohoe, of the Balmain Electric Lighting Corporation, has been appointed to make the necessary report and advise the municipality generally on the advisability of carrying out the scheme. The city is at present lighted with gas.

An agreement has been signed between the Municipal Council of Hawthorn (V.) and the Melbourne Electric Supply Co., Ltd., by which this company contracts to supply the City of Hawthorn with electric light and power for a term of 14 years. The Hawthorn ratepayers individually are to have the option of being charged for electrical energy at the price fixed by the Melbourne Electric Supply Co., or at the rate ruling for the supply of electrical energy to other consumers within a radius of 10 miles from Melbourne G.P.O.—*Australian Mining Standard.*

The Prahran (V.) City Council refuse destructor and electricity generating plant during the past 12 months treated 7,692 tons of refuse and generated 343,010 units of electricity—an average of 44·6 units per ton of refuse collected. The revenue from sale of energy which is purchased in bulk by the Melbourne Electric Supply Co., Ltd., amounted to £699.

Barnstaple.—At a meeting of the T.C. on Monday, Mr. Hadfield, the municipal electrical engineer, reporting in regard to the recent fire at the Imperial Hotel, said he was perfectly satisfied that it was caused by a gas explosion, and that the electrical installation had nothing to do with it. With a properly designed and carried out electrical installation, there was, he insisted, no danger of fire. Mr. C. A. Youings, the proprietor of the hotel, said all he could say was that the electric light went out, and that there was a big explosion. Mr. Hadfield added that pipes were blown out of their sockets, but there was no electrical effect whatever. The Mayor remarked that the official repairer had informed him that, on examination, the electric light wires were found to be perfect, whilst there was no fraying of the covering. At Plymouth a gas explosion had occurred without any electricity in the place, and he understood "that under certain atmospheric conditions, gas would explode even without a light."

Barrhead.—There is a prospect of the streets of Barrhead, near Glasgow, being shortly lighted with electricity. At present the Clyde Valley Electrical Power Co.'s cable is being extended along Main Street, the complete lengthening being about half a mile.

Bexhill.—A rather alarming accident occurred at the electricity works through the bursting of a 4-in. steam valve attached to one of the boilers. Fragments of metal were blown through the glass ventilator, and there was a big escape of steam, but the mishap was promptly grappled with, and there was no interruption in the supply.

Bolton.—A Lancashire correspondent informs us that several manufacturers in the Bolton district are about to adopt the individual electric drive in their weaving sheds.

Brentford.—At the meeting of the U.D.C. a letter was read from the B. of T. intimating that as no steps had been taken under the Brentford Electric Lighting Order, 1905, it was proposed to revoke it. The U.D.C. was asked if it had any objections to offer. In reply to Mr. Dorey, the clerk stated that the E.L. company was never floated; it was decided to raise no objection to the extinction of the order.

Canterbury.—In order to secure a *locus standi*, the T.C. has decided to oppose the East Kent Electric Power Bill, a transfer of which is to be made to the Kent Collieries Co. One of the provisions of the Bill gives power to supply energy in bulk

Clitheroe.—It is announced in the *London Gazette* that the B. of T. has revoked the 1904 prov. order.

Continental Notes.—Germany.—Owing to the extension of the supply mains, not only throughout the town of Strasburg, but also to the suburbs and outlying villages, the generating plant, which in 1908 had a capacity of 11,000 H.P., became inadequate; no more space being available at the old generating station, a large area of adjoining land was acquired, on which, in 1909, the erection of a second station capable of accommodating plant up to 30,000 H.P. was commenced, and this was completed about the middle of last year. A battery of six Steinmuller water-tube boilers, each having a heating surface of 400 sq. metres, and fitted with superheaters, was installed, as well as a number of electric cranes and a conveyor, for conveying the coal from the ships in the river direct to the boilers or to the coal store, which has a capacity of 6,000 tons. The generating plant consists of two 1,500-H.P. sets of A.E.G.-Curtis steam turbines and dynamos, and a similar set of 4,000 H.P. The current generated is alternating at 3,000 volts, the smaller sets each giving 1,100 KW. at a speed of 3,000 R.P.M., and the 4,000-H.P. set, 2,800 KW. at 1,500 R.P.M. Already it has been found necessary to order more plant—this time a 6,000-H.P. steam turbine and alternator—and when this is in operation in the autumn the capacity of the new station will be 13,000 H.P., and of the two plants of the company 24,000 H.P. The number of incandescent and arc lamps and electric motors connected up at the commencement of the present year was equal to 31,922 KW.

A company has just been formed in Coblenz with the title Die Mittel-Rheinische Electricitätswert Gesellschaft to undertake the supply of electrical energy for lighting and power purposes to a number of small towns in the Coblenz district.

Austria.—The Czernowitzer Electricitätswerke Gesellschaft has decided on the construction of a second central station in the town of Czernowitz.

Crayford.—The P.C. has approached the Bexley U.D.C. with reference to the lighting of the parish by electricity. The Dartford U.D.C., which has also been approached, has replied that the matter will be favourably considered on receipt of information as to the requirements of the parish.

Derby.—A L.G.B. inquiry was held by Mr. T. C. Elkin, M.I.C.E., on Thursday last week, into an application by the T.C. for sanction to two new loans on account of the electricity undertaking. A sum of £6,650 is intended for an extension of mains in the Osmaston district, where an additional 800 H.P. is already required by three firms. It is proposed to supply the power on the three-phase system, and to utilise the single-phase supply for lighting alone. Another sum of £8,500 represents the annual addition to capital expenditure, £5,250 being the estimated cost of new mains, and £2,000 of meters. There was no opposition to the applications.

The total output for the past financial year was 5,573,706 units, an increase of 19 per cent. upon the preceding 12 months.

Grays.—The U.D.C. has decided to supply current free to consumers for illuminations on the evening of Coronation Day.

Guildford.—The E.L. Co. has communicated with the B. of G. with reference of an installation of the electric light at the workhouse and infirmary. It offers to bear the initial outlay, charging the Board the prime cost in 10 annual instalments. It also guarantees a substantial reduction in the present cost of lighting by gas. The matter has been referred to the Visiting Committee.

Guisborough.—A strong Committee, consisting of most of the prominent tradesmen of the town, has been formed to press forward the introduction of electric lighting. The charges for gas are high, and the lease for public lighting expires shortly.

Heston and Isleworth.—The U.D.C. has decided to enter into an agreement with the Twickenham Electric Supply Co. to supply current in bulk for the purposes of Whitton Park Estate, which is an isolated portion of the Twickenham District. The U.D.C. has secured a reduction in the charge of water from the Water Board for "stand-by" purposes from £24 to £6 per annum. It has been decided to extend the mains in Hounslow Heath district by 1,000 yards at a cost of £400.

Itchen.—The U.D.C. has decided not to appeal to Southampton for an electricity supply, as outlined in a resolution put forward by a member, one argument against the proposal being that the need could be met by local enterprise.

Japan.—According to the last Japanese mail, the municipal authorities of Yokohama have decided to collect from the Yokohama Electric Co., 7 per cent. of the profits of the undertaking in addition to the tax imposed on electric poles at the rate of 1s. 6d. per pole.

London.—MARYLEBONE.—A 10 years' agreement has been entered into with the Town Properties Development Co., Ltd., for the supply of electricity to 5, Portland Place. The contract will supersede a ten years' agreement on the maximum demand system, and will stop the farming-out of current at the flats. An agreement has been entered into with Mr. Peczenick to supply electricity on the telephone system to Hallam Street Chambers for three years, with the option to increase the term to eight years. The charge made for fuse replacements is to be discontinued except in special circumstances. The revenue is small, and the labour entailed in collection, correspondence, &c., is great, while the matter is frequently a source of great irritation to consumers. The general manager has made a long report upon the conversion of gas lamps to electricity. He says that the estimate for the work was £20,900, while the actual cost was £18,313; estimated number of lamps to be converted was 1,385, while the actual number converted was 1,371. The saving in cost against the estimate would have been greater had not local labour been employed, as the department started with £1,500 in hand by purchasing materials below the estimated figures. It was difficult to say exactly what had been the actual cost of employing local labour, but the effect of employing local labour was a general slowing up of the usual pace and an increase in the reinstatement charges owing to the breakage of paving stones, which no amount of supervision could counteract when such men are engaged. The employment of unskilled local labour also necessitated additional gangers. The maximum number of local men engaged at any one time was 98, and of these 30 had to be dismissed for incompetency, drunkenness and other reasons other than the completion of the job. In conclusion, Mr. Seabrook said that there could be no doubt that mixing the local and unskilled men with good skilled labourers had a demoralising effect upon the latter.

WESTMINSTER.—The City Council has agreed with the Charing Cross Electricity Supply Co. for the company to remove 19 electric lamps on refuges, and erect 19 temporary lamps for the Coronation; six on brackets from buildings, and 13 suspended above the centre of the roadways by wires. The price quoted for the work is £450, but the company says that as it is extremely difficult to give an accurate estimate, it will carry it out at the actual cost. The additional current taken by the company's temporary lamps will be estimated, and will be chargeable to the Council at the usual rates.

Loughborough.—A L.G.B. inquiry was held on May 19th into the application of the T.C. for a loan of £2,310 for electricity purposes. It is proposed to extend the plant by substituting for the present two 250-KW. dynamos two of 350-KW. capacity. The present plant will be retained as a stand-by. There was no opposition.

Mansfield.—The T.C., having applied to the L.G.B. for authority to borrow £4,000 for its electrical undertaking, an inquiry was held by Mr. T. C. Ekin, an Inspector of the Board. The works commenced supplying current in June, 1903, and in January, 1908, the engineer made a suggestion that the time had arrived for putting down additional plant. In 1909-10 and also in 1910-11 there was a decrease in the number of units sold in consequence of the introduction of metal-filament lamps. Tenders have now, however, been received for £1,960 for engines and £915 for dynamos. Mr. E. H. Hewlett, the borough electrical engineer, said the output was now increasing, and, in his opinion, the undertaking had turned the corner. From 1907 to 1910, following the introduction of metal-filament lamps, although there was an increase of 25 per cent. in the number of customers of the electricity department, there was an actual decrease in the sale of current. Since then an increase of 50 per cent. in the customers has produced, so far, an increase of 16 per cent. in the sales.

Nottingham.—In its annual budget statement the Finance Committee of the City Council estimates receipts during the ensuing year of £15,000 from the electric tramways and £15,350 from the electricity undertaking, these amounts to be contributed out of the profits of the two concerns in reduction of the district rate. The sums contributed last year were: tramways, £21,000; electricity, £16,350. A year ago the Assessment Committee raised the assessment of the trading concerns by £13,000, the electricity undertaking being put up £6,000, the tramways £3,000, and the gas undertaking £4,000. The amount received from the district rate as the proportion of that increased assessment was £4,062, of which the electricity concern contributed £1,875 and the tramways £937.

Oldham.—The T.C. has decided to supply to consumers free current for Coronation illuminations, provided suitable devices are erected.

Pontardawe.—The R.D.C. has decided to interview Mr. John Morgan, electrical engineer, of Cardiff, with reference to the lighting of the populous districts in the Council's area by electricity.

Portsmouth.—During the past year there has been a saving of £1,750 in coal consumption at the electric light station, which is almost entirely due to the Committee having adopted turbines.

Reeth.—Arrangements have been made with Mr. Burton, of Askrigg, to light the parish by electricity. Lamps of a total C.P. of 1,050 will be provided, at a cost of £20 per year. The present oil lighting costs £20 per 10-C.P. lamp per annum.

Rotherham.—A L.G.B. inquiry was held last week relative to the application of the T.C. for a loan of £27,832 for E.L. purposes. There was no opposition.

Runcorn.—The new works of the Salt Union, Ltd., Weston Point, Runcorn, were opened on the 18th inst. Electricity is being utilised for the purpose of evaporating the water from the brine. So much electricity is being made by the company that enormous quantities of spare power are being sold to other manufacturers. The works of the Liverpool Cable Co. at Helsby, seven miles away, are taking current for all purposes, and electricity for both power and illuminating purposes is to be sold in the adjacent townships of Runcorn and Widnes at a low rate. Serious rivalry came from Spain six years ago, salt being produced on the Mediterranean shores by a natural process of sun evaporation—the cheapest imaginable, and the English manufacturers have suffered the gradual loss of the great Indian market. It is with the object of saving this that the new plant has been constructed at Runcorn, practically on the seaboard. It is said that the loss of dues of the River Weaver will mean a difference of £20,000 a year to the trustees of the waterway.

Uruguay.—The Finance Minister has requested the directors of the Monte Video Electric Light Station to make a full report on all existing electric light stations throughout the country, with a view to their nationalisation. The directors are also to formulate a scheme for establishing stations in various parts of the Republic.—*Review of the River Plate.*

Whitwood.—The electric light undertaking was formally inaugurated on Friday night by Mr. C. T. Hardy, J.P. (chairman of the Council). The scheme provides for 250 street lights, while numerous private consumers have been already connected, and many more applications have been received. It is proposed to supply householders with electricity at 3d. per unit, while power users will be charged 2d. per unit. The work has been carried out by Messrs. Callender's Cable & Construction Co., Ltd.

Wood Green.—The Council is taking a poll of the district on the question of establishing an electric supply undertaking for the district, under the powers of its electric lighting order. Under the proposed scheme, a supply of electricity would be taken

in bulk from the North Metropolitan Electric Supply Co. and distributed by the Council to the users in the district. With the charges proposed, it is estimated that upon a sale of 330,000 units the earnings would be sufficient to cover the cost of the bulk supply, the distribution and management expenses, the interest on the loans, and the annual instalments for the repayment of such loans, and to leave a small margin to the good.

Yarmouth.—The electricity undertaking shows a gross profit for the year ended March 31st of £8,267. Of this amount £431 was written off the cost of meters, transformers, &c., £7,466 was applied to interest and sinking fund and £370 was added to the appropriation account. Of the balance, £982 is to be added to the reserve fund, thus increasing that fund to £4,000.

TRAMWAY and RAILWAY NOTES.

Accrington.—It was stated at the T.C. meeting last week that the Tramway Committee's results had exceeded the expectations of 12 months ago. A deficit of £999 was estimated, but there was an actual deficit of only £355. Mr. Waddington said through-running arrangements to Rawtenstall had been very beneficial; he could see no reason to alter his opinion that the benefit to Rawtenstall and Haslingden would be £250 a year to each Corporation.

Argentina.—Messrs. Gandulfo & Co., concessionaires for a tramway between Avellaneda and La Plata, have applied to the Provincial Government to rescind the decree by which the concession was declared lapsed. It is now their intention to carry out the work.

Australia.—For some months a committee has been investigating a proposal for the purchase of the Perth (W.A.) electric tramways by the municipalities, but it is now reported that the price at which it would pay the councils to make the purchase is so much below the company's figure that it is useless to proceed further with the negotiations. The system was valued by Mr. McCarthy, a Melbourne expert, at £257,024, without goodwill. The company's balance-sheet for 1909 showed the capital cost to be £474,274. The company last November offered to sell for £600,000. The annual profit of the company is £31,000, of which preference shares, interest and sinking fund on first and second mortgage debentures absorb £23,422, leaving a dividend of 1½ per cent. to ordinary shareholders. The city treasurer estimated that £10,000 a year would be required for depreciation and renewals. If the municipalities bought at £350,000 the profits would pay merely interest and sinking fund on the purchase price. If bought at £600,000 the annual loss would be £15,000. It has, therefore, been decided to abandon the proposed purchase.

A legal opinion has been obtained to the effect that municipal councils have still the power to licence people to run motor-'buses in competition with the tramways, and the Mayor (Ald. Molloy) has been instructed to make inquiries in England, with a view to instituting an up-to-date motor system in Perth.—*Australian Mining Standard.*

Belfast.—At the meeting of the Tramways and Electrical Committee on the 22nd inst., the city accountant presented the audited accounts of the tramways undertaking for the year ended March 31st, 1911. In the figures presented in the general manager's report some small adjustments had been made by which the balance carried to the net revenue account was increased to £105,501. Fixed charges and depreciation had been provided for, and £16,730 had been carried to the statutory reserve fund, which has now to its credit the sum of £20,000. This left a balance of £455, which is transferable to the general purpose fund. Mr. Geale also submitted the following estimate for the current year: Revenue, £227,000. Expenditure—working expenses, £122,000; interest, £42,000; sinking fund, contribution, £24,500; general purposes fund, £9,000; depreciation fund, £13,000—£211,000. Estimated surplus, £16,000. Both these statements were adopted, and formal resolutions were passed in regard to the appropriation of the balances, as already approved by the Committee and the Council, together with a resolution continuing the existing fares and stages for the present year, including, of course, the concessions granted to all the passengers paying their fares before 9 a.m. It was decided, on the recommendation of the manager of the tramways and the electrical engineer, to grant one day's extra pay to all the employés of the Committee who must of necessity work on Coronation Day, June 22nd.

Brighton.—The T.C. has decided to oppose the Brighton, Hove and District Railless Traction Bill, which seeks to run cars from Brighton to Rottingdean.

Continental Notes.—Spain.—A company has just been formed in Paris, with a capital of £160,000, and the title La Compagnie des Tramways de Valliran a Barcelone et Extensions, to construct and work an electric tramway between Valliran and Barcelona.

France.—According to the *Standard*, the last part of the electric railway from Villefranche and Vernet-les-Bains to the Spanish frontier will be opened for public service towards the middle of June. The cost of this railway of about 35 miles has been nearly £1,280,000.

Doncaster.—The Tramways Committee has under consideration a detailed estimate of expenditure and income in connection with the scheme for laying down a tramway to Brodsworth. The length of the track as projected is 3 miles 624 yards, the estimated total cost of the work being £25,700.

Glasgow.—Discussion of tramway department working absorbed much of the time of the T.C. at its last meeting. The first topic was whether or not the experiment of the two-stage fares should be continued, and the convener, in moving that the trial be extended for another year, said that from a financial point of view the tramways accounts had not been affected in any way. They had expected that the result of the traffic would have been disastrous, but it had not turned out so. Mr. Macfarlane demurred to the statement that the introduction of the two-stage fare had caused an increased number of passengers, and argued that that was merely an outcome of improved trade. The increase was long past due and ought to have been 10 or 12 per cent. instead of 6 per cent. The extension was ultimately agreed to by 36 votes to 33.

At a later stage, in speaking to a recommendation by the Tramways Finance Committee—"That the general manager be instructed to make allowance for depreciation on lines similar to the depreciation allowed in the accounts for the year ending May 31st last"—Mr. Macfarlane explained that some years ago the depreciation was at the rate of £800 per double mile. Later, that was found to be an absolutely inadequate allowance, therefore the rate was raised to £1,000. They had had a good deal of experience since then—six years longer—and they found that the average life of the entire system of permanent way was not more than 10 or 11 years. During the past seven years they had extended their track 40 miles and they had not spent a penny on capital or renewal on that track, because it was not needed for a matter of three or four years yet, and they were simply laying aside a sum to cover that when it became due. The minute was approved.

Hastings.—A petition signed by several thousand ratepayers has just been presented to the T.C. in favour of the substitution of overhead wires on the Front Line Tramways in lieu of the existing Dolter surface-contact system. It is also announced that with the support of the Corporation the Tramways Co. will apply to Parliament in the matter. Doubtless there is still a strong feeling against overhead wires on the Front by many residents on the route. The whole matter is being considered by the Railway and Tramway Committee of the Corporation.

London.—L.C.C.—A report from the Highways Committee dealing with the tramway estimates for 1911-12, deals at some length with the question of tramway and omnibus working, and points out that the tramways not only pay rates for the occupation of the roads over which they run, but also maintain a considerable portion of the road paving, for the wear of which they are obviously in no way responsible. Apart from street cleaning, the relief to local authorities in the matter of road maintenance is estimated at £118,000 a year; the rates on the lines average over ½d. in the £ of London rates, and the total rates payable in 1911-12 will amount to £135,000, being £98,000 for permanent way and £37,000 in respect of buildings. It is further estimated that the Council's all-night and workmen's car services involve a loss of £70,000 a year. The Committee points out that the omnibus companies pay no rates for the roads they use, neither do they undertake any road maintenance or provide all-night services or workmen's fares. Moreover, the 'bus routes traversing the City and West-end have a fairly uniform all-day traffic, whereas the suburban tramway route is subject to peak loads, both morning and night, which increase the expense of operating such routes. These remarks prepare the way for the announcement of a surplus for the year just ended, less than was anticipated, and for a decreased surplus for the year 1911-12 as compared with the year just closed.

Middlesbrough.—The General Purposes Committee of the Corporation has decided to continue its opposition to the Tees-side Tramways Bill.

Watford.—The Herts C.C. has applied to the Light Railway Commissioners for an order authorising the construction of a tramway at Watford, which will be linked up with the present system, and will be over 6 furlongs in length.

TELEGRAPH and TELEPHONE NOTES.

Hull.—The annual accounts of the Hull Corporation telephone undertaking for 1910-11 were published last week; they showed an income of £12,550, and expenditure £7,523, leaving gross profit £5,027. The net profit was put at £1,168. The income had increased by £826, and the expenditure by £622. The Government royalty was £1,258.

International Telephony.—The Italian Government has resolved to proceed with improvements in the international telephone service at a cost of £128,000. It is intended to establish two new lines in connection with communication with Germany, one being between Rome, Milan and the Simplon tunnel, and the other being between Turin and Milan. In addition, there will be lines between Milan and the Swiss frontier and two direct lines to

Basle and Lucerne. Although details are not known, it is said that the great international line will begin in Milan, and, following the St. Gothard Railway, will lead to Berlin *viâ* Frankfort-on-Main. By means of the special wire, the connection between Italy and Germany will be better than that between the former and France, where no special wire exists. Switzerland is not to be connected with the German-Italian service, but will receive payment for the use of the route.

Korea.—The Government authorities in Korea are considering a scheme for the establishment of a long-distance telephone line between Seoul and Fasan, in addition to the existing telephone services between Seoul, Shigan, and Makan.

Long-Distance Telephony.—The new telephone circuit between New York and Denver, U.S.A., a distance of 2,011 miles, was opened on the 8th inst. The line is of heavy copper wire (No. 8 B.W.G.), and difficulties had been experienced in applying loading coils to aerial circuits over No. 12 gauge, owing to leakage on the line, which exerts a very important effect on the transmission over a heavy line with loading coils. According to the *Telegraph and Telephone Age*, it was found necessary to replace all the insulators, 285,000 in number, on 87,000 poles, in order to attain success. By the use of "phantom" circuits, for which special loading coils had to be devised, it was made possible to obtain three telephone circuits with four wires, which, moreover, are simultaneously used for the transmission of eight telegraphic messages. The total cost of the adaptation of the existing circuits has been £20,000; if new lines had been erected sufficiently heavy to be used without loading coils, the cost would have been £320,000. The possibility of telephoning between New York and San Francisco, a distance of 3,000 miles, is now under consideration.

Motor-Cars in Telephone Service.—The New York Telephone Co. has lately ordered no fewer than 100 motor-cars; 63 of the vehicles are of the two-seated pleasure type, 20 of them being intended for the use of the commercial department in connection with the canvassing of clients in new districts; 10 will be set apart for district traffic superintendents, and 33 are intended for the service of the construction and repair departments. The remaining 37 machines will consist of 1-ton and 3-ton motor-lorries for the transport of apparatus and construction work.

The Polyphone.—The addition of a flexible tube and ear plate to the ordinary hand-set turns it into a "polyphone," a Swedish invention, which in a short time has become very popular throughout Scandinavia. Besides bringing both ears into use, the device has the advantage of shutting out external sounds; the auxiliary ear-plate also makes it possible for two persons to listen to a message simultaneously.

Telephone Delays.—In the House of Commons, Mr. Astor asked the Postmaster-General whether the National Telephone Co. were refusing to supply applicants with telephones on the Gerrard Exchange, and whether the Post Office was refusing to supply applicants with telephones on the Mayfair Exchange; and, if so, whether he would take immediate steps to enable inhabitants in the neighbourhood of those exchanges to install instruments. Mr. Herbert Samuel replied that he understood that the existing equipment of the National Telephone Co.'s Gerrard Exchange was working at its full capacity, and the same was practically true of the Post Office Mayfair Exchange. New apparatus was, however, being added at Mayfair to provide accommodation for additional subscribers, and was expected to be ready next month. As soon as the Gerrard Exchange came into his hands steps would be taken to provide additional accommodation there also. The company stated that they were unable to undertake any extensions at present.

Telephone Reforms.—Amongst the reforms which the Postmaster-General proposes to introduce into the postal and telegraphic services this year is the extension of the telephone to farmers on the party-line system, at the rate of £3 per annum for unlimited calls within a restricted area, with a small charge for calls beyond that area. There will be five stations on each line. The system has been in experimental use for some months in the Yorkshire village of Brandsby, where two lines have been installed, and the results are said to have been most satisfactory and highly beneficial to the users.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 30th. One portable petrol-driven desiccating plant, for the P.M.G.'s Department in Victoria. See "Official Notices" April 7th.

May 31st.—7,000 insulators and wire and line material, for the P.M.G.'s Department in South Australia. See "Official Notices" April 7th.

June 7th.—Two nauts of submarine cable, single core, for the P.M.G.'s Department in New South Wales. See "Official Notices" April 28th.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

June 14th.—Cable, ironwork, cast-iron pipes, iron or steel poles, phosphor-bronze wire, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" May 5th.

June 27th.—1,400 protectors for use on main distributing frames at magneto exchanges, for the P.M.G.'s Department in Victoria. See "Official Notices" May 5th.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" March 24th.

Barnes.—June 9th. Pipework, &c., and one 600-KW. generator panel, for the U.D.C. See "Official Notices" to-day.

Bath.—The T.C. has decided to invite tenders for additional cells for the refuse destructor.

Beckenham.—June 12th. Electric wiring of houses, for the U.D.C. See "Official Notices" May 19th.

Blackpool.—Arc lamp carbons for two years, for the Corporation Electricity Department. See "Official Notices" to-day.

Bulgaria.—Tenders have just been invited by the municipal authorities of Russe, for the establishment of a central electric lighting station in the town.

Canada.—TORONTO.—June 6th. Board of Control, City Hall. (1) Pumps and electrical equipment for the city main drainage works; also (2) screening, elevating and conveying apparatus, and (3) castings and indicating and recording apparatus for Venturi meters. Specifications, forms of tender and deposits required for each of the three sections, at the Board of Trade Commercial Intelligence Department in London.

Devonport.—June 8th. D.C. meters, paper-insulated cables and rubber-covered wires, for the Corporation. See "Official Notices" to-day.

Eccles.—June 10th. The Education Committee invites tenders for various scientific electrical apparatus for the new schools. Specifications and forms of tender from the secretary of the Education Committee. S. H. Meave, Town Hall.

Glasgow.—May 29th. 70,000 tons of coal for the Corporation electricity stations. W. W. Lackie, city electrical engineer.

May 29th. Supplies for the year for the electrical stores department of the Clyde Navigation Trustees. Tenders to general manager and secretary, T. R. Mackenzie, 16, Robertson Street.

Hemsworth (near Wakefield).—Electric light wiring, &c., of new Hippodrome. Specification from W. E. Richardson, architect, Rothwell, Leeds.

Heston and Isleworth.—June 14th. Metallic-filament lamps for street lighting (400 posts), for one year, for the U.D.C. See "Official Notices" May 19th.

Hungary.—The municipal authorities of Alberti have just invited tenders for the concession for the electric lighting of the town during a period of 50 years.

London.—ST. PANCRAS.—May 31st. Welsh or other steam coal for the electricity supply stations, for 12 months.

STEPNEY.—June 8th. Ampere-hour meters, demand indicators, time switches, and arc lamp carbons, for a year, for the B.C. See "Official Notices" May 19th.

HAMMERSMITH.—May 31st. High-pressure steam and feed-water pipes, exhaust steam feed heater and circulating water pipes, steam valves and feed-water heaters, and feed pump, for the B.C. See "Official Notices" May 19th.

L.C.C.—July 4th. Four electric traversers for car-sheds. See "Official Notices" to-day.

POPLAR.—June 19th. One 3,000-KW. turbine alternator, with surface condensing plant, two water-tube boilers with superheaters, air heaters, fans and chimneys, one 30-ton electric overhead travelling crane and water-softening plant, for the B.C. See "Official Notices" to-day.

Manchester.—June 2nd. The Corporation Electricity Department; tenders for various stores. Specifications from secretary, F. E. Hughes, Town Hall.

Mansfield.—The Electricity Committee recently instructed the manager to obtain tenders for a stock of cable, and the acceptance of a tender was left with the chairman and manager.

Mexborough.—June 10th. Balancer-booster set for the U.D.C. Electricity Department. See "Official Notices" to-day.

Oldham.—One 1,200-KW. mixed pressure steam turbine coupled to two D.C. generators in tandem, with barometric condenser, pumps, &c., for the Corporation. See "Official Notices" to-day.

Stalybridge.—June 1st. Engine fuel and stores, for a year, for the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board; Robert Blackmore, engineer-in-chief.

Stockport.—June 14th. Materials for the Corporation Electricity and Tramways Departments. See "Official Notices" to-day.

New Zealand.—One each 15 and 20-H.P. electric motors and two sets of gear, for the Auckland Harbour Board. See "Official Notices" May 19th.

Roumania.—The municipal authorities of Calarasbi are about to invite tenders for the concession for the electric lighting of the town during a period of 35 years.

Swansea.—Tenders are to be invited for the wiring for electric light of the slaughter-house in the cattle market.

Worthing.—June 12th. Two Diesel oil engines and continuous-current generators, for the Corporation. See "Official Notices" May 19th.

CLOSED.

Australia.—Messrs. André Citroën & Co., makers of machine-cut helical gears, have received a contract for the complete gearing outfit of a large dredger which the Fitzroy Dockyard is building for the New South Wales (Australia) Government.

According to the *Australian Mining Standard*, the Prahran and Malvern Tramways Trust has accepted the tender of Noyes Bros. Proprietary, Ltd. (£657), for steel poles for the Dandenong Road tramway.

The same exchange states that the N.S.W. Postmaster-General's Department has ordered from the Federal Potteries and Brick Works, Brunswick (V.), glazed earthenware conduits, as follows:—50,000 lineal ft., six ducts, at 3s. per lineal ft.; 7,500 do., four do., at 2s. do.; 500 do., nine do., at 4s. 6d. do.

The *Australian Mining and Engineering Review* reports the following contracts placed:—

Municipal Council of Sydney:

Mains fault-localising set, £397.—Messrs. Nicholson & Bainton, Sydney.
Transformers, £805.—Australian General Electric Co., Sydney.
Switchgear, £1,020.—Messrs. Noyes Bros., Ltd., Sydney.

Dunedin (N.Z.) City Council Tramways Committee:

Messrs. Briscoe & Co.—Steel girder, rails and fishplates, £1,865 10s. Rails to be manufactured by the North-Eastern Steel Co., Middlesbrough.
National Electric Co.—Constant-current transformers.

Binley Colliery.—The tender of the British Westinghouse Co., at £4,459, for the supply and erection of the necessary exhaust-steam turbine plant at Messrs. Merry & Cuninghame's Binley Colliery, near Coventry, has been accepted by Messrs. Stevenson & McGuffie, of Glasgow, the consulting engineers. The following were the tenders received:—

British Westinghouse Co.	£4,459
Belliss & Morcom	4,467
British Thomson-Houston Co.	4,477
Willans & Robinson	4,549
Oerlikon Co.	4,818
A.E.G. Co.	4,839

Birmingham.—The Corporation has placed with the Paterson Engineering Co., Ltd., a repeat order for one of their Paterson oil eliminators with quartz sand filter for the removal of all trace of oil from 350,000 lb. of condensed steam per hour, with a peak load of 500,000 lb. This with the Paterson oil eliminator installed at the Summer Lane generating station in 1908 will, we learn, constitute the largest plant of its kind in existence. We understand that the present order was placed as a result of the satisfactory working during the last three years of the existing plant, the boilers being kept free from oil at a cost for chemical reagents of ·169d. per thousand gallons purified. The combined plant will have a capacity of 800,000 lb. per hour.

Blackpool.—The contract for the electric lighting of the new Carnegie Central Public Library, Blackpool, has been placed with Messrs. J. W. Fielding & Co., of that town.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

ADMIRALTY, CONTRACT DEPARTMENT.

Switches, sockets, &c.—British Insulated and Helsby Cables, Ltd.; Edison and Swan Electric Light Co., Ltd.; Evered & Co., Ltd.; Hawkes, Ltd.; India-Rubber, &c., Co., Ltd.; W. McGeoch & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Veritys, Ltd.; A. Watson & Co.; Westminster Engineering Co., Ltd.

WAR OFFICE.

Storage batteries.—Tudor Accumulator Co., Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Accumulators.—D.P. Battery Co.
Cable.—British Insulated and Helsby Cables, Ltd.
Cable core, &c.—India-Rubber, &c., Co.
Fans.—Veritys, Ltd.
I.R. sheet.—Warne & Co.
Insulators.—Bullers, Ltd.; Taylor, Tunnicliff & Co.
Motor, &c.—British Westinghouse Electric, &c., Co.

CROWN AGENTS FOR THE COLONIES.

Electric materials.—General Electric Co., Ltd.
Switches and crossings.—T. Summerson & Sons, Ltd.

OFFICE OF WORKS.

Electric bellhanger's work.—John C. Christie.

GENERAL POST OFFICE.

Telephonic apparatus.—Western Electric Co., Ltd.
Battery boxes.—Houghton's, Ltd.
Paper-core cable.—British Insulated and Helsby Cables, Ltd.; Johnson and Phillips, Ltd.
S. and C. core cable.—Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Electric lighting of new Money Order Office, Holloway, London, N.—W. J. Furse & Co.
Telephone (Local) Exchange equipment at Wimbledon, S.W.—British Insulated and Helsby Cables, Ltd.
Wireless telegraph power plant at Browhead, Crookhaven Island.—Marconi's Wireless Telegraph Co., Ltd.

Colchester.—The Essex Education Committee has accepted the tender of Messrs. Joslins, Ltd., of Colchester, for the electric light installation at the Secondary Schools, at £439.

Electrical Installation Contracts.—Messrs. Siemens Bros. Dynamo Works, Ltd., have secured an order for the electrical equipment of the new works of the Carlyle Trading and Investments Trust, Ltd, at Bromley, Bow, including the supply of generators, motors, switchboards and electric lighting. The wiring has been sub-let by Messrs. Siemens to Messrs. Walter Mossop and Co. Messrs. Siemens have also secured an order for a country-house lighting installation at Chudleigh, Devonshire, including generating plant, accumulator battery, switchboard and lighting. The wiring, which is being carried out with Stannos wires on the concentric system, has been sub-let to Messrs. A. H. Brooking and Co., electrical contractors, Exeter.

Greenock.—The Corporation has placed the following contracts in connection with the extension to Dellingburn power station:—

Coal and ash bunkers and conveying plant.—Babcock & Wilcox, Ltd.
Two water-tube boilers with chain-grate stokers; one 2,000-KW. turbo-alternator with condensing plant; two 500-KW. rotary converters.—British Westinghouse Electric and Manufacturing Co., Ltd.

Hindhead.—The D.P. Battery Co., Ltd., have secured the contract for the new battery for Hindhead Central Station.

Isle of Thanet.—The B. of G. has accepted the tender of Messrs. Anderson & Co., of London, for lightning conductors for the workhouse, at £34.

London.—MARYLEBONE.—The B.C. has accepted the following tenders for annual supplies for the electricity undertaking:—

Carbon brushes.—Le Carbone, Ltd.
Oils.—Middleton Bros.
Underground cables.—Aubert, Grenier & Co.
Disconnecting boxes and cast-iron pits.—Sykes & Sugden.
Meter boards.—W. T. Henley's Telegraph Works, Ltd.
Rubber tubing and manhole rings.—The Avon India-Rubber Co., Ltd.
India-rubber insertion.—Rubber Co. of Scotland.
Para rubber strip and black adhesive tape.—Siemens Bros.
White Silesian tape.—Pooley & Austin.
Rubber gloves.—St. Helens Cable and Rubber Co.
House-service boxes.—Callender's Cable Co., Ltd., Sykes & Sugden, and W. Lucy & Co. (for lowest items respectively).
Cast-iron piping.—F. Bird & Co.
Commutator.—Parsons & Co., Ltd., £220.
Truck capable of carrying 15 to 20 cwt.—Electrical Power Storage Co., Ltd., £260.

ISLINGTON.—The Guardians have accepted the tender of the Private Telephone Co. for the installation of a new fire alarm system at the school, at £65 10s.

L.C.C.—For overhead fittings required at the Bow and Hammersmith car-sheds, the tender of Messrs. Brecknell, Munro & Rogers, Ltd., at £77, has been accepted.

The Highways Committee is accepting the tender of the Enfield Autocar Co., Ltd., for two motor cars, at £954, including electric lighting equipment for all lamps.

SOUTHWARK.—The B.C. has accepted the tender of the Western Electric Co. for 440 yd. of ·1 cable, at £100, and for 440 yd. of ·05 cable, at £63.

Luton.—The T.C. has accepted the following tenders:—

W. H. Allen, Son & Co., Ltd.—Condenser of 4,500 sq. ft. tube surface, £1,455.
E. Green & Son, Ltd.—Economiser with 122 tubes, £191; and renewal of sections of present economiser, £18 15s. per section.

Mersey Docks and Harbour Board.—The Board has accepted the tender of Sir W. G. Armstrong, Whitworth & Co., Ltd., for six electric loading-off-wall cranes.

Plymouth.—The Electricity Committee has placed a contract with Messrs. Cory Bros., Ltd., for 8,000 tons of coal at 13s. 6d. per ton, as compared with 13s. 4½d. for the last contract.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

J. T. Halsey, Southend.—Wiring two ward blocks at the Sanatorium, £47.
S. Stone & Co., London.—24 driving-wheel tires, £15 9s. per ton; 12 pony-wheel tires, £18 9s. 6d. per ton; and apparatus for enabling the driver of a car to control electrically points over which the car is about to pass, £45.
Edgar Allen & Co.—Tramway points and crossings, £267.
Peckham Truck Co.—Special flexible truck, £125.
W. Bane & Co.—Tie-bars for permanent-way, 10¼d. each.

West Ham.—The Corporation has accepted the following tenders in connection with the car depôt extension and the construction of the Prince Regent Lane tramways:—

Walter Scott, Ltd.—500 tons steel girder rails and 18 tons steel fish-plates, £3,809.
Bayliss, Jones & Bayliss, Ltd.—Tie-bars, fish bolts, and anchor plates, £418.
Edgar Allen & Co., Ltd.—Points and crossings and construction of lay-outs in cast steel, £520; do., in manganese steel (including "leg crossings"), £1,979.
Watlington & Co., Ltd.—Traction poles and fittings, £772.

Late Legal.—The case of the British Westinghouse Electric and Manufacturing Co., Ltd., *v.* the Underground Electric Railways Co., Ltd., came before a Divisional Court of King's Bench on Wednesday, on a motion by the claimants to set aside an arbitration award in regard to an alleged breach of contract. Our report is held over until next week, but after argument, the summons was dismissed with costs, without the Court delivering any judgment as to whether the Divisional Court was right or wrong.

FORTHCOMING EVENTS.

Physical Society.—Friday, May 26th. At 3 p.m. Visit to the National Physical Laboratory, Teddington.

University of London.—May 29th, 30th, 31st, and June 1st and 2nd. At the Institution of Electrical Engineers. At 5.30 p.m. Special course of lectures by Dr. A. E. Kennelly, on "The Application of Hyperbolic Functions to Electrical Engineering Problems."

National Electrical Manufacturers' Association (Inc.).—Thursday, June 1st. At 2.30 p.m. At Balfour House, Finsbury Pavement, E.C. Meeting of Council.

Institution of Mining Engineers.—Thursday, June 1st. At 11 a.m. At the Geological Society, Burlington House, W. General meeting. Discussion on Mr. J. Burns's paper on "Progress in the Use of Exhaust Steam Power," and other papers and discussions. At 7.30 p.m.: Dinner at the Trocadero Restaurant.

Friday, June 2nd.—Visit to the Kent Collieries and sinkings of the Kent Collieries, &c. Leave Victoria Station at 11.20.

Royal Institution.—Thursday, June 1st. At 3 p.m. Lecture on "Changes Effected by Light," by Mr. T. Thorne Baker.

Friday, June 2nd.—At 9 p.m. Discourse on "Radiotelegraphy," by Commendatore G. Marconi.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued:—

Commanding Officer—COL. H. M. LEAF.

Monday, May 29th.—"A" Company. Infantry drill, 7 to 8 p.m.; technical drill, 8 to 10 p.m.

Tuesday, May 30th.—"B" Company. Technical drill, 7.30 to 10 p.m.

Wednesday, May 31st.—All Companies. Annual course of musketry at Purfleet rifle ranges. Tickets can be obtained at headquarters on application.

Thursday, June 1st.—"C" Company. Recruits' infantry drill, 6.30 to 7.30 p.m.; technical drill, 7 to 8.15 p.m.; company drill at Millbank Barracks, 8.30 to 9 p.m. Dress: Drill order.

Friday, June 2nd.—"D" Company. Recruits' infantry drill, 7 to 8 p.m.; company drill at Millbank Barracks, 7.30 to 9 p.m.; technical drill, 9 to 10 p.m.

Saturday, June 3rd.—No parades.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt., L.E.E.

NOTES.

A Felixstowe Exhibition.—At an Industrial Exhibition recently held in Felixstowe, an interesting stall devoted to electric cooking was organised by the Suffolk Electricity Supply Co., Ltd. On this stall practical cooking demonstrations were given; the most notable features were the large diving-bell ovens designed by Mr. Napier Prentice, and the ovens of the British Thomson-Houston Co. and the Bastian Co.

One of the diving-bell ovens was used for baking bread, and we understand that the energy necessary for baking a stone of bread does not exceed 1,400 watt-hours. Standard bread, the flour for which was ground by electricity in the building, was in great demand, and, although the oven could turn out a batch of six or eight loaves each hour, it was impossible to keep up with the demand at 4d. per loaf, the price being kept artificially high on account of the big demand.

The "Lightning" griller was publicly exhibited for the first time, sausages, bacon, toast and other sundry small articles being grilled in a few minutes; the current consumption was very small, two pieces of toast requiring only $\frac{1}{10}$th of a unit starting from cold, or 1 lb. of sausages $\frac{1}{10}$th of a unit.

Amongst the saucepans, frying pans, kettles and irons, we noticed excellent samples from the Premier Electric Heating Co., and the British Thomson-Houston Co., Ltd.

Another interesting feature of the cooking display was the manipulation of the electrical apparatus by ladies connected with an Ipswich organisation for Women's Suffrage, who volunteered for the work, and incidentally demonstrated the ease with which anyone can use electric cooking appliances.

Messrs. W. Simms & Co. showed a fine assortment of electrical fittings, some of the bronzes being particularly beautiful, and a complete installation was shown for country house lighting, consisting of a Hornsby-Stockport gas engine and Aston dynamo and switchboard; and Mr. E. G. Everett showed a complete installation of a "Standard flour" mill, driven by an electric motor, making 80 per cent. Standard flour, which was used in the electric bakery.

Our friends the gas company were, of course, in evidence for cooking, and with the assistance of a professional cook an unknown quantity of gas assisted to keep the building hot, which at sunny Felixstowe was surely unnecessary.

Electrical Fatalities.—The adjourned inquest touching the death of J. G. Christy and G. Young, platelayers, who were killed in the Duffryn Woods, Abercwmboi, was held at Mountain Ash on Wednesday last week. According to the *Western Mail* report, Mr. W. N. Atkinson, chief inspector of mines, represented the Home Office; Mr. R. Nelson, his Majesty's electrical inspector of mines, was also present. W. Gallaway, foreman platelayer to the Powell-Duffryn Co., said that the two men worked in his gang. They proceeded to the Duffryn Woods to prepare some holes for electric poles. Witness observed smoke rising higher up in the wood, and he sent Young to inquire into the cause of it. Later he sent Christy in the same direction to a neighbouring quarry to fetch some tools. Subsequently the two men were found lying dead in proximity to the electric pole, which had caught fire.

Frederick Taylor, another platelayer, spoke to finding the two men dead. Christy was grasping one of the electric stays.

Mr. George Hann, the deputy general manager of the Powell-Duffryn Co., said that one of the insulators on the pole, near where the men were found, had come loose, with the result that the current had got in contact with the stay, which supported the pole. This had caused the fire. There was nothing to suggest why Christy caught hold of this wire. A new pole had been placed higher up on the night preceding the accident. In his opinion the insulator had come loose on account of the pulling of the wire.

William Coles, the foreman at the Powell-Duffryn power station, said that the line voltage was 3,000. The leakage was not sufficient to cause the relays to work.

George Flanders, electrical engineer, stated that the escaping voltage was 1,850.

The Coroner: It would be well if the company were to put up notices warning people not to touch these stays.

Robert Thomas, lineman, said that the line was in perfect order after the erection of the fresh pole on the night preceding the accident. The new pole was appreciably higher than the pole next to it.

Dr. Jones said that both men were killed instantaneously.

A verdict of "Death by misadventure" was returned.

Stoke-on-Trent.—Application is to be made to the B. of T. by the Corporation Electricity Committee for consent to supply on the E.H.T. three-phase system in the borough, as required by the Electric Lighting Acts. The tender of Callender's Cable and Construction Co., Ltd., at £14,185, has been accepted for mains and feeders, subject to the sanction of the L.G.B. being obtained to the loan of £60,000 applied for by the Corporation. At the forthcoming L.G.B. inquiry strenuous opposition is anticipated, and the town clerk has been empowered to engage counsel and expert witnesses in support of the application should he consider it advisable.

Electrical Publicity Matter.—Another batch of publicity matter has been issued by the Electric Supply Publicity Committee for the use of supply undertakings. It includes power leaflets addressed individually to engineers, bakers and printers, also dealing with electro-plating works and saw mills; pamphlets to builders, housewives, &c., on the advantage of introducing the electric service, and one on the safety of electric light. A two-page circular on the advantageous use of electricity in the nursery, and a much-needed booklet on useful electrical apparatus—containing brief illustrated descriptions and an indication of the cost of the more generally used electrical appliances—are welcome results of the committee's efforts. The cards, circulars, &c., issued by the committee are of suitable size for enclosing with accounts and letters.

Colliery Managers at Trafford Park.—In view of the annual meeting of the National Association of Colliery Managers, which was held in Manchester on May 18th, 19th and 20th, the BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., extended to the members of this Association a cordial invitation to pay a visit to their works, and inspect some of their apparatus particularly suitable for mines. A fairly large number of members availed themselves of this offer, and made a tour of the shops under the guidance of several Westinghouse engineers. A special exhibition of mining switchgear had been arranged, including a complete line of 750, 3,300 and 6,600-volt mining switch pillars, also examples of type "S" gate-end switch boxes specially designed for use in shallow headings, oil-switches, circuit breakers, auto-starters, liquid starters, controllers, rheostats, &c. A large variety of switchboards of all types were going through the shops, and full access to all the details of manufacture was freely given. There were also on view steam turbines, condensers, with Leblanc air pumps, turbo-blowers, the R. T. Moore turbine-driven high-lift pump for 400 g.p.m. against 827 ft., running at 3,300 R.P.M., large and small gas engines, motors, generators, and other apparatus, including 2-speed motors of 180 H.P. 400 volts D.C. driving a Worthington hydraulic pump rated at 250 gallons per minute, at 800 lb. per sq. in., for the L. & N.W. Railway, London Road station. The visitors were afterwards entertained to tea by the company.

The Coronation Exhibition.—The White City buildings and grounds at Shepherd's Bush are this year occupied by the Coronation Exhibition. Its aim is to represent to the visitor the greatness of the British Empire. The Exhibition was opened on Thursday, 18th inst., by H.R.H. Prince Arthur of Connaught, and on the previous day the buildings and grounds were inspected by a large party of representatives of the Press.

At the luncheon which preceded the inspection the chair was taken by Lord Blyth, the chairman of the Executive Committee, and others present included Lord Rotherham, Mr Imre Kiralfy, Sir L. Alma-Tadema, and many others who have taken a prominent part in organising the Exhibition. The Duke of Teck sent an apology for absence. He has acted as Hon. President of the Exhibition and has taken an active part in the deliberations of the Committee. After the usual loyal toasts, which were proposed by Lord Blyth and enthusiastically honoured, that of the German Emperor and Empress was similarly observed. Lord Rotherham

then proposed "Success to the Coronation Exhibition." After eulogising the work which Mr. Kiralfy and various members of his family had done on behalf of the Exhibitions held at Shepherd's Bush, he predicted that the present one would prove quite as successful as its predecessors. There were other great Exhibitions being held in London this year, but there were also the exceptional number of visitors who would, many of them, be attracted to the various shows. It was not given to all who deserved success to achieve it, but the efforts made by the organisers of the Coronation Exhibition would, he hoped, meet with their due reward.

Sir L. Alma-Tadema responded on behalf of the Art Section, and mentioned what care had been taken to secure a worthy representation of modern art. In responding to the toast, Mr. Imre Kiralfy hoped that the labours not only of the staff, but also of the Organising Committee, would be rewarded with success; the Exhibition enabled one to realise in a way almost impossible hitherto the wonders of the Empire. The toast of the Press was proposed and acknowledged, and the visitors then proceeded on a tour of inspection of the various buildings.

The well-known Court of Honour is still there, the lagoon and canals are still crowded with pleasure craft, the gardens are as beautiful as ever, and in many cases improved, but the buildings are, so far as interiors go, entirely different. Perhaps a word must be given to the Hall of Splendour, observed on entering from Wood Lane. This represents the Audience Chamber of an Indian Palace, and is a fitting prelude to the visit to the adjacent Courts where Indian scenes are depicted, and Indian work is carried on amid surroundings which, as nearly as possible, reproduce actual scenes.

Not only Indian but Colonial scenes are represented in the various buildings; there is a good art section, and in one part of the old Machinery Building there is a good Press exhibit in which the various great newspapers show a number of interesting curiosities.

Perhaps, however, the most interesting section to this year's scientific visitor is the Science exhibit in the overhead gallery between the Wood Lane and Uxbridge Road entrances. Here a most interesting exhibit has been arranged under the direction of Sir Alexander Pedler, F.R.S. A working installation of the Marconi system has been erected, showing how the apparatus is fitted up on the Cunard line of steamships. Communications are maintained with distant parts of the Exhibition grounds. The University of Bristol show through their Botanical Department the latest methods of inducing rapid plant growth by means of electrical discharges. Some very interesting astronomical exhibits are on view, and the seismograph is shown in actual operation. This instrument enabled the earthquakes at Messina and Mount Pelée to be recorded in the Isle of Wight and in Berlin. A large number of other scientific novelties are shown, and visitors to the Exhibition should take special pains not to miss this instructive exhibit.

Copper.—In a well-considered article a writer in the *Times* of May 20th reviews the copper position with reference to the much-discussed reduction of output convention. An agreement for this purpose was, according to the article, arrived at by the large producers, both in this country and America, last July. Taking total visible supplies, as well as detailed figures, from Messrs. Merton's statistics, the agreement does not appear to have remained in force after November, 1910. The quotation for standard copper at the end of June, 1910, was £54 10s., a figure to which the price had declined from December 31st, 1909. On the strength of the limitation, however, the price went up by November, 1910, to £57 5s. It has apparently been impossible to maintain this price, the increase in American stocks probably influencing the market. The recent slight revival in copper prices is attributed to improvement in demand. There is also, of course, always a tendency for manufacturers to renew stocks when prices appear low. Some good judges, says the *Times* article, incline to the opinion that a turning point has been reached, and that a recovery in prices is imminent. If this is the case, it would appear to denote a cessation in the efforts to bring about an agreement of the copper interests for the time being.

Regenerating Arrangement for Röntgen Tubes.—In order to regenerate Röntgen tubes, that is, to restore the necessary degree of hardness for practical purposes, which is lost by their constant use, the Rodde Röntgenröhrenfabrik G.m.b.H., of Berlin, has devised a regenerating process which possesses considerable advantages. A regulating addition is fused on to the cathode tube, which contains a small quantity of a substance which gives off, when heated, a gas specially suitable to the atmosphere within the tube. The heating is effected by the current of a small dry cell. For this purpose an india-rubber cap is fitted to the additional tube, which carries two terminals connected with the regulating substance by platinum wires. The regeneration is simply effected by applying a dry cell to the terminals of the regulating addition. The process is extremely simple and practical; it has the advantage over other regenerative processes, that the alteration sought for is easily recognised, so that the regeneration can be stopped so soon as the hardness required is reached, and the regeneration can be carried on while the tube is in use without affecting the activity of the rays. The noiselessness of the new process is a third advantage.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—At a meeting of the West of Scotland Branch, on May 19th, at Glasgow, Mr. John W. Case, Hamilton, read a paper on "The Use of Electricity in Gaseous Mines." After some experience of the two-wire insulated system with unarmoured cables, he was of the opinion that such cables were unsafe to use in any mine. The insulated system with twin-core armoured cable was the safest direct-current system to use in a gassy mine. The main switch controlling each section should be fitted with a trip connected to the armouring in such a way that immediately the slightest leakage occurred on that section, the section was cut out. In dry mines, particularly in seams in which the rock had a high electrical resistance, it was almost impossible effectively to earth the apparatus; earth plates were useless, and no other method could be adopted with reliability than earth trips fitted to switches in each section. The earthed concentric system was also safe provided the armour had a conductivity at least equal to that of the inner core. Some definite rule ought to be made for earthed concentric systems similar to the Board of Trade rule regulating tramways, namely, 7 volts drop between the end of the rails and the station negative bus-bar. In the three-phase system, armoured three-core cables should be used wherever possible. Coal dust was the principal medium by which electricity could cause damage. It rested on every possible projection, and found its way through the smallest hole or crevice. Cables formed a very convenient shelf on which it might rest, and in the event of a short-circuit taking place in the cable the dust was suddenly raised by the vibrations of the cable, and became an explosive mixture close to any faulty portion. It was advisable to have all cables and other electrical apparatus regularly brushed to clear them of coal dust.

Mr. H. A. McGuffie, Glasgow, in opening the discussion, referred to the suggested trip gear, and said he had seen several attempts made to get gear of this description to work satisfactorily, but the results had been anything but efficient. There were now many systems in use which gave effect to the requirements Mr. Case mentioned, but these could only be introduced in large and new installations, and did not apply to small collieries, the capital outlay being too high. The earthed concentric system should not be used on voltages above 500, or for powers exceeding 400 or 500 H.P. In several instances he had found bad leakages to water-pipes, &c. In one case the difference in pressure was approximately 40 volts. The trouble was traced to a bad joint on the outer, although the joint in question appeared quite satisfactory from the outside.

Institution of Electrical Engineers (Yorkshire Local Section).—At the annual general meeting of the Yorkshire Local Section, on Wednesday last week, the following gentlemen were elected for the ensuing session:—Chairman, T. Harding Churton (second year of office); vice-chairmen, Wilson Hartnell (second year of office), and Walter Emmott; hon. secretary, H. Dickinson; new members of the Committee, Messrs. G. D. A. Parr, H. Visger, W. N. Y. King and E. S. Rayner.

Victorian Institute of Electrical Engineers.—The sixth annual meeting of the Institute was held in Melbourne on March 23rd; Mr. A. H. Jackson, retiring president, occupied the chair; Messrs. P. J. Pringle, G. B. Lincolne and G. H. Broome were elected to membership. The following office-bearers were elected for the ensuing year:—President, Mr. Percy Rosling; vice-presidents, Messrs. W. H. Alabaster, J. H. D. Brearley; hon. secretary, E. H. W. Westwood. The report of the Council stated that during the year a marked improvement in the progress of the Institute was noticeable, the membership having increased by 37 members, five associates, and six students. The membership now totals 114. Proposals are on foot with a view to bringing about an amalgamation with the New South Wales Electrical Association, and it is expected that something definite in the matter of the formation of an Australian Institute of Electrical Engineers will be settled shortly.—*Aust. M. and E. R.*

University of London.—A special course of five lectures on "The Application of Hyperbolic Functions to Electrical Engineering Problems" is to be given at the Institution of Electrical Engineers, by Dr. A. E. Kennelly, of Harvard University. The lectures are addressed to advanced students of the University and to others interested in the subject dealt with, and will commence at 5.30 p.m. on May 29th, 30th and 31st, and June 1st and 2nd; admission is free by ticket obtainable from the Secretary of the Institution of Electrical Engineers.

Electrical Trades Benevolent Institution.—As a number of further additions to the list of donations is expected, we are delaying publication of it for the present in order to make the final announcement as complete as possible.

Public Time.—We have often urged the need of accurate public time service, and of the abolition of the numerous clocks which continue to mislead the public by their erratic and irresponsible indications; we are therefore pleased to note that a public clock which can be trusted was installed at Marble Arch on Tuesday. It has been presented to the Borough of St. Marylebone by Mrs. Mocatta, and consists of two large dials facing east and west, fixed upon an arc lamp standard in Oxford Street, opposite the end of Park Lane. These dials are operated by an electrical time transmitter contained in a cast-iron pillar on the refuge, which receives an electrical impulse every hour from Greenwich Observatory, and provides the half-minute impulses necessary to propel the hands of the clock faces. It does this quite automatically, so the clock never requires to be wound up. Though clock faces have as yet only been fixed to one arc lamp standard, there is no reason why others should not be installed, as the controlling mechanism will operate any number, and the dials themselves are ideally simple, the only works they contain being one wheel and an electromagnet. The work has been carried out by the Synchronome Co. on the system invented by Mr. Hope-Jones, who has been advocating municipal time service for many years. We hope that this will serve as an object lesson to other boroughs, both metropolitan and provincial.

Appointments Vacant.—Teacher for electric wiring evening classes at the County School, Twickenham (12s. 6d. per lesson). Switchboard attendant for the Torquay Electricity Works (30s.). See our advertisement pages in this issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. T. R. STANCOMBE, chief assistant electrical engineer to the Barnsley Corporation, has been appointed sales engineer to the Yorkshire Electric Power Co. The appointment of assistant construction engineer has not yet been made.

MR. C. F. W. SEDGWICK, shift engineer, St. Helens Corporation Electricity Works, has been appointed out of 156 applicants to a similar position under the Sunderland Corporation.

The *Australian Mining Standard* states that MR. F. E. SPENCER, of Melbourne, has been appointed electrical engineer to the Redfern (Sydney) Council, to fill the vacancy caused by the death of Mr. J. Balfour.

MR. F. BROOME, the commercial manager of the Electricity Department, Swansea, has been appointed manager of the Buxton Baths.

Tramway Officials.—The Doncaster T.C., sitting in Committee on May 16th, rejected a recommendation to increase the salary of MR. E. S. RAYNER, manager of the electrical and tramway department, from £400 to £450 per annum.

In connection with the proposal to separate the offices of electrical engineer and tramway manager, the Perth Tramway Committee now recommends that MR. SNELL, who at present acts as traffic manager, should be appointed manager, and that MR. LAMBERT, the electrical engineer, should continue to take charge of the overhead equipment and supply of energy for the Tramway Committee.

The Birmingham Corporation Tramways Committee recommends that the salaries of MR. J. MCDONNELL, traffic superintendent, and MR. S. B. N. MARSH, accountant of the department, be advanced from £250 to £300 each, as from April 1st.

General.—The marriage took place on April 4th at St. John's Pro-Cathedral, Buenos Ayres (by the Ven. Archdeacon Kittermaster), of MR. T. C. HUNT, electrical engineer to the Central Northern State Railway of Argentina, to Miss Edith May Hitch, daughter of Mr. Ernest H. Hitch, of Ware. Mr. Hunt was for some years connected with the Corporation of West Ham electrical undertaking, and went out to Argentina in 1907.

MR. CHARLES KNIGHT, who for the last few years has been engaged at Messrs. Siemens's Glasgow branch, was, on 19th inst., presented with a pair of binoculars by the staff at Rothesay Dock power station, and that of Messrs. Siemens at present engaged there, on his leaving this country for Australia. Mr. Stormont, the electrical engineer, made the presentation, and on behalf of the subscribers wished Mr. Knight every success in the land of the Kangaroo.

MR. H. SILLAR, superintendent at Mirfield of the construction depôt of the Yorkshire Electric Power Co., Ltd., is leaving for Canada next month.

MR. E. MURRAY GIBBES, of Sydney, is now on a visit to London (Imperial Hotel, Russell Square, W.C.), and while in this country is desirous of fixing up on behalf of his firm—Messrs. Scheele and Gibbes, Ltd., importers, of Hunter Street, Sydney, N.S.W.—agencies for British electrical manufacturers, &c.

MR. WILLIAM SMITH, senior superintendent, has been appointed Controller of the Telegraphs in Scotland, in succession to Mr. R. D. Binsted, who recently retired. Mr. Smith entered the service of the International Telegraph Co. in 1869.

MR. E. A. UTTLEY, electrical inspector to the Rhodesian Government, arrived in this country on Tuesday by the *Durham Castle* for a stay of six months.

Obituary.—MR. E. RISTORI.—We regret to record the sudden death of Mr. Emanuel Ristori, which occurred on Thursday morning last week, the verdict of the jury being "Accidental death from an overdose of sulphonal." The deceased gentleman, who was 57 years of age, was a nephew of Adelaide Ristori, the famous Italian actress. He received his early training as an engineer and in scientific work generally in Italy, and when about 21 years of age he came to this country in connection with Nordenfelt, his interest then centring in the making of big guns. He next joined Nobel whom he assisted in all his early experiments with smokeless powder, and he induced the Italian Government to take up the latter. After his connection with Nobel, Mr. Ristori organised the British Aluminium Co., purchasing the patents and bringing out the company at the end of 1894. With this company he was connected as managing director up to 1902. Mr. W. Murray Morrison, who had been associated with the company from its inception, took over Mr. Ristori's duties at that date, when the board underwent reorganisation. Mr. Morrison continues with the company to-day as its general manager and technical adviser. The deceased gentleman organised the works of the company at Foyers, Larne, Milton and Greenock, and he was the originator of the Kinlochleven power scheme, acquiring some of the earlier rights, though this work has been carried to completion since he left the concern. He was also intimately connected with the company's bauxite mines in the South of France. Since leaving the undertaking he has taken an interest in Scottish water-power development, has had a good deal to do with the Heroult electric steel process, and latterly has been occupied to some extent with the fixation of atmospheric nitrogen. He was an Associate Member of the Institution of Civil Engineers, and a member of the Council of the Institute of Metals which was formed a year or two ago. It was stated at the inquest that Mr. Ristori had had business worries and had been taking sulphonal tablets for sleeplessness.

BARON D'ERLANGER.—Baron D'Erlanger, whose death is just announced at the age of 79 years, was chairman of the New General Traction Co., Ltd., and a director of the Norwich and Coventry Tramways Companies; he was also chairman of the Lahmeyer Electrical Co., Ltd.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Paignton Electric Light and Power Co., Ltd. (98,437).—Particulars of £5,000 second debentures, created November 28th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Prested Miners' Gas Indicating Electric Lamp Co., Ltd. (76,081).—Particulars of £1,000 debentures, created April 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £750. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electrical Installations, Ltd. (91,050).—A memorandum of satisfaction to the extent of £450 on January 16th, 1911, of debentures dated December 5th, 1906, securing £2,000, has been filed.

Simms Magneto Co., Ltd. (95,109).—Issue on April 12th of £3,500 debentures, part of a series of which particulars have already been filed.

Aron Electricity Meter, Ltd. (58,650).—Particulars of £100,000 debentures, created January 17th, and secured by trust deed dated April 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, and company's interest in land and buildings at Schweidnitz, subject to trust deed dated 1901, securing £60,000, of which £4,500 remains outstanding. Trustees: Consolidated Trust, Ltd., Dashwood House, 9, New Broad Street, E.C.

Float Electric Co., Ltd. (107,336).—Second mortgage debenture dated April 10th, 1911, to secure £7,000, charged on the company's undertaking and property, present and future, including uncalled capital, subject to first debenture for £2,800. Holder: C. J. W. Blundell, Blundell House, Campden Hill.

Buenos Ayres City and Suburban Tramways, Ltd. (114,031).—Agreement for loan, dated April 29th, 1911, to secure not more than £64,000, charged on the company's undertaking and assets. Holders: Buenos Ayres Port and City Tramways, Ltd.

Traction Supplies Co., Ltd. (104,338).—Particulars of £1,000 debentures, created November 15th, 1910, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future. No trustees.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors, in their report for 1910 (to December), say that, although the plant was only lightly loaded for the first eight months of that period, largely owing to the fire at the Great Boulder Perseverance Mine, the profits in Kalgoorlie show an increase over those for the 12 months ended December 31st, 1909. The additions made to plant and machinery during the year include new boilers and condensing apparatus, as well as the new engine and alternator referred to as the new unit in last year's report. To assist in providing for the cost, the balance of the authorised issue of £60,000 first mortgage 6 per cent. debentures has been sold, and the cost of issue written off as shown in the profit and loss account. A further sum of £4,000 has been added to reserve for depreciation and renewals, bringing this item up to £23,000. An amicable and satisfactory settlement of the dispute over the 1909 unit of plant, referred to last year, has been made. On March 31st the tramway company exercised their option under the contracts with this company, to pay the existing price for a further term of five years. The retiring director is the chairman, Mr. R. W. Wallace, K.C., who, being eligible, offers himself for re-election.

CITY NOTES.

Johnson & Phillips, Ltd.

LAST week we were only able to give a brief intimation of the result of the operations during the year ended December 31st, 1910. The report reads as follows: "It will be seen by the profit and loss account that the profit for the year on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £5,337 for maintenance of buildings, plant, &c., amounts to £23,175, plus balance brought forward from 1909, £942 = £24,117. Deduct remuneration of directors', auditors' and trustees' fees £1,564, interest on debenture stock to December 31st, 1910, £7,478, reserve *re* debenture sinking fund £5,438, interest on second debentures to December 31st, 1910, £1,488, depreciation on machinery and plant, &c., £4,500, amount written off investments £1,500, carrying forward to next account £2,154. The directors are pleased to report that the business of the company during the year under review has shown considerable improvement. The profit for the year shows an increase of £7,815 over the preceding year. The directors have to report the death of Mr. J. D. Bonner since the date of the last meeting, and wish to express their deep regret at the loss of a valued colleague." Sir Henry Benbow, one of the directors, retires by rotation, and does not offer himself for re-election.

The annual meeting was held yesterday.

Tata Hydro-Electric Co., Ltd.

THE *Times of India* reports that a meeting of shareholders was held last month at Bombay, Sir Dorab J. Tata presiding.

In moving the adoption of the report, the CHAIRMAN said that it was their first meeting. All the ordinary shares had been taken up, and about 900 preference shares still remained to be subscribed. This was not because they could not dispose of them; but they reserved shares worth about eight lakhs of rupees in case the firms with whom they made contracts might prefer to be paid in shares. They had entered into a contract with Messrs. Callender's Cable and Construction Co., Ltd., for the supply of cables, and this company had agreed to take part payment in preference shares to the extent of 3½ lakhs of rupees for cables supplied. In this way they were enabled to make favourable bargains. There were many applications from the outside public for shares, and they had to be refused. He hoped that the remaining shares would be taken up in that manner by firms of contractors. He congratulated the shareholders on securing, as manager, Mr. H. P. Gibbs, who had not only great experience as manager of the Cauvery Works, but had a good knowledge of construction work. The original duct line was being resurveyed with a view to a saving of expenditure. Other resurveys were being carried on with a view to economy being made in expenditure, and he believed that the resurvey of the duct line would result in a substantial saving. Their engineering staff was the best that could be obtained. The work was progressing at a rapid pace and at rates which compared favourably with the original estimates. The number of men employed on the work was also satisfactory. He assured them that every attention was being paid to secure economy in expenditure, and to enable the men to work under shelter.

The report was adopted.

Sir Vithaldas D. Thackersay, Mr. Narotum Morarji Gokuldas and Mr. W. H. White, who retired by rotation, were re-elected directors.

Urban Electric Supply Co., Ltd.—The directors' report states that for the year ended December 31st, 1910, the gross profits amount to £47,268, and after deducting the London expenses there is a balance of £44,911, which has been carried down to net profit and loss account. The profit balance is £30,971, which falls short by £1,528 of the amount of £32,500 required to meet the 5 per cent. guaranteed dividends on the capital. This deficit, being the debit balance as shown in the accounts, has been duly provided by Edmundsons' Electricity Corporation, Ltd., under their contract. Provision has been made of £2,221 for depreciation of plant and machinery under the terms of the same contract. The profits for 1910 exceed by £33,192 the amount of £12,107 required to meet the debenture interest. The company continues to make satisfactory progress, and its prospects are encouraging. In view, however, of the expiry, on December 31st last, of the contract under which the dividends have hitherto been guaranteed, of the necessity for increasing the amount of the provision for depreciation, and of the fact that the debt owing to the contractors is now bearing interest, the directors have decided to defer any declaration of dividend for the current year until the accounts for the year are available.

Anglo-Portuguese Telephone Co., Ltd.—Final divided of 5 per cent., making a total of 8 per cent. for 1910. £4,723 is carried forward.

Winnipeg Electric Railway Co.—A quarterly dividend at the rate of 12 per cent. per annum (an increase of 2 per cent. compared with the previous year), payable on July 1st, 1911, is declared.

Potteries Electric Traction Co., Ltd.

THE directors report that the capital expenditure during the year ended December 31st, 1910, amounted to £1,785, made up principally of the cost of additions to the permanent way; the amount of £5,302. Underwriting commission on shares has been written off to reserve account. The total receipts for the year amounted to £110,481. The traffic receipts, which amounted to £92,350, show an increase of £418, and the return to the company on its investment in the North Staffordshire Tramways Co., an increase of £1,157, consequent on the declaration of a bonus of 2s. per share on the ordinary shares. The working expenses show an increase of £2,320, of which £1,090 is accounted for by increased expenditure on the permanent way. After deducting all expenses chargeable to revenue, including £11,978 for debenture and other interest, there remains a balance of £26,334, making with £1,051, the balance brought forward from the previous year a total of £27,385, as compared with £27,291 for 1909. The directors recommend that the amount available for distribution should be applied as follows:—Depreciation—reserve account, £2,302; renewals account, £7,525; dividend at the rate of 5 per cent. per annum on the preference shares, £12,250; dividend at the rate of 2 per cent. per annum on the ordinary shares, £4,900; carrying forward, £407. The depreciation and reserve account will then stand at £19,000, and there will be a credit balance on the renewals account of £9,000. During the year £10,521 has been expended on the improvement, renewal and repair of the permanent way, of which £6,496 has been charged against the year's revenue, and £4,025 to the renewals account. During the year the company applied to the Board of Trade for, and obtained release from, its obligations to construct certain authorised extensions in the outlying districts of the Potteries, the construction of which, in the opinion of the board, would have entailed a heavy annual loss to the company.

	1909.	1910.
Miles open—		
Route miles	31·68	31·68
Single line	21 88	21 88
Double line	9·80	9·80
Passengers carried	18,362,359	17,838,197
Average receipts per passenger	1·20d.	1·24d.
Average working expenditure per passenger	·73d.	·78d.
Proportion of expenses to receipts	61 %	63 %
Cars in stock	110	110

Hong Kong Tramway Co., Ltd.

THE directors' report for the year ended December 31st, 1910, states that there is again a considerable increase in the gross traffic receipts, as compared with those of the previous year, which is, however, partly accounted for by the higher rate of exchange, viz., 1s. $9\frac{3}{16}$d. per dollar, as against 1s. $8\frac{15}{16}$d.; but, in spite of the large increase in such receipts, viz., £3,564, the net traffic receipts show an increase of £764 only, the difference being entirely due to a further shrinkage in the values of the subsidiary coinage. This question having become still more acute, the directors (says the *Financial News* abstract) considered it necessary themselves to take steps to protect the interests of the company, and, after much careful consideration and reference to Hong Kong, it was decided to charge an additional cent for every 5-cent fare paid in Chinese copper coins. The change first came into operation on December 4th, 1910, and promises to be a success. The board also consider it highly satisfactory that, while the receipts have increased, the working expenses show a decrease of nearly £1,500 upon the previous year. The result for the year, after providing for all working expenses and the payment of debenture interest, is a profit of £7,988, which, added to the amount brought forward from last year, makes a total of £8,557, which is carried forward. In accordance with the undertaking given to the debenture-holders last year, the above £7,988 is to be expended, with a further sum, making £10,000 in all, in permanent improvements or additions to the company's property before the payment of any dividend. Additions and improvements will, it is expected, cost about £10,000, and will appear in the accounts for the current year. Besides strengthening the security of the debenture-holders, the company's earning powers will be increased, and it will be enabled to cope with all the traffic anticipated for some years to come. The accounts submitted show the effect of the reduction of capital, which was sanctioned by the shareholders in July last, and confirmed by the High Court on December 13th, 1910.

The annual meeting was held on Wednesday.

Prospectuses.—*Waste Heat and Gas Electrical Generating Stations, Ltd.*—This company is now offering for subscription a further issue of 160,000 shares of £1 each at 21s. per share. The proceeds will be applied in payment of contracts for the construction of new stations, and in taking up further shares in the Bankfoot Power Co., Ltd.

Torquay Tramways Co., Ltd.—An issue of £60,000 5 per cent. prior lien debentures at 95 per cent. is being offered, the list of subscriptions closing to-day, Friday. A contract has been arranged with the National Electric Construction Co., Ltd., for carrying out extensions to the system for £48,500 (maximum), and the balance of the money now to be raised has already been expended in the conversion of the surface-contact lines to overhead trolley, for reasons with which our readers are already fully acquainted.

Electric Supply Corporation, Ltd.—Subscriptions are now being invited for £60,000 5 per cent. debenture stock. A report of the company's annual meeting is given on the next page.

Uxbridge and District Electric Supply Co., Ltd.—The list is open until Monday next in an issue of £75,000 5 per cent. first mortgage debenture stock at 100 per cent.

Electric Supply Corporation, Ltd.

The ninth annual meeting of the above company was held on Monday, at Salisbury House, E.C., Mr. J. G. B. Stone (chairman) presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 811), said they were aware that the company had for some time past been embarrassed by the large amount of temporary loans. These items now entirely disappeared from the balance-sheet, as the whole of these loans had been repaid by a sale of their debenture stock, and the company now stood with cash in hand for the development of its business. With regard to the general growth of the company's business, the lamp connections had risen from 113,699 to 135,719, an increase of 19 per cent., which was satisfactory. To the increase, Dumbarton was the largest contributor. With regard to their shareholding in the Dumbarton Tramway Co. they had disposed of the preference and retained 29,490, roughly about three-eighths of the total ordinary capital. On the latter they did not yet receive income, but the increased earnings led them to expect some return before long. As foreshadowed at the last meeting they now had direct representation on the board. With regard to the Hendon company, the total issued capital had been increased to £30,000, and they held £18,965, or roughly, two-thirds. They anticipated that they would receive dividends from their holding in this company for the current year, and the prospects were very encouraging. They would observe the remarkable growth of this company's business in the figures in the report. The lamp connections at the beginning of this month had increased to 44,644, with 4,400 more waiting. Turning to the report, they would see that this year they brought into their account the actual cost of renewals and repairs; hitherto this item had been provided under the guarantee of the auxiliary company. This charge and the increase in interest on loans, &c., reduced the surplus at their disposal to £3,960. They proposed to put a further £500 to renewals account, which increased the total to £7,767 standing to the credit of that account; also to write off £314 and the sum of £934, representing the balance of expenditure in Hendon. They would then have a net balance of £2,212, which they would carry forward to the new year. With regard to the table of progress, there was a small decrease in the number of units supplied, although the revenue had increased. There were two causes for this decrease. The first was the reduction in the supply to the tramway company at Dumbarton and the second the strike of the shipbuilding employés in that district. The shipbuilding strike was now a thing of the past, and the Dumbarton district was extremely prosperous. Its prosperity was manifest from the increased business they were doing in the town. In spite of a shrinkage in output from these causes, they had an increase in gross revenue of £1,665 and of £1,924 in profit. The small increase in the capital account was almost entirely represented by expenditure in connecting new consumers. The revenue account showed increased receipts and reduced costs—a satisfactory state of affairs. Before he sat down, the shareholders would like some indication of when their ordinary shares were going to receive a dividend. They thought they would receive some dividend this year, but they did not like to commit themselves to what it would be. They hoped it would be something in the neighbourhood of 3 per cent., and in such a business as theirs, when once they began to receive dividends there should be continual increases until the dividend got to a satisfactory amount.

Sir Home Gordon seconded the motion, and the report was adopted without discussion.

On the motion of Mr. F. R. Reeves, Mr. R. T. Hinckes was re-elected a director.

Replying to a vote of thanks, the Chairman said he had been connected with the company ever since it was started. They had had very difficult times, but he really thought now they had got through their difficulties, and were going to be successful and pay reasonable and proper dividends to the shareholders.

Western Telegraph Co., Ltd.

The meeting of this company was held at Electra House, E.C., on Wednesday, May 17th, Sir J. Wolfe Barry, K.C.B., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, May 12th, page 760), said that it showed a satisfactory condition of the affairs of the company. The revenue from messages for the half-year compared with the corresponding period for 1909, was increased by nearly £46,000, but a diminution in the amount of interest on investments, &c., reduced this by about £5,500, leaving a net increased revenue of about £40,500. The reduced amount of interest was consequent upon the sale of reserve fund investments during the year 1910, which represented a cost value of £360,000. These sales were necessary to meet payments for new cables, &c. The increase in traffic receipts was derived from all the countries served by the company's system. On the other hand, there was an increase in the general expenses at the stations and for the maintenance of cables, and in the expenses of the repairing ships, amounting in all to £22,000. The increased expenditure at the stations was caused by additional staff to meet increasing traffic, by annual promotions, and by the enhanced value of the Brazilian currency. In November last he referred to the charter of the cable steamer *Cambria* to enable their own steamer *Norseman* to come to England for survey and repairs. The latter vessel had now been on cable work for 25 years, and on examination it was gratifying to say that the deterioration was much less than might have been expected. The overhaul, repairs, and installation of wireless telegraph apparatus &c., cost £7,500. This, and the extra cost of the chartered vessel accounted for the increase of expenditure under Abstract C of the accounts. An exceptional item which appeared in the accounts was "interest on loans." To avoid further sales of reserve fund investments, sums were borrowed from Associated Companies, which had since been repaid as funds accumulated. After providing £16,373 for debenture stock interest, and £7,697 for income-tax, there remained a balance of £245,142 plus £7,512 brought forward, making a total of £252,655. First and second interim dividends, amounting to £62,379, had been paid, and after transferring £150,000 to the general reserve fund, and £10,000 to the land and building depreciation fund, there remained a balance of £30,276, which was carried forward. The revenue for the current period to date compared satisfactorily with former years, but a few weeks ago a reduction of 75 centimes per word in the tariff with Brazil was made, and a considerable increase in traffic would be required to recoup them for the reduction in the charges for telegrams. The cable between St. Vincent (Cape Verd) and the island of Ascension, to which reference was made at the last meeting, was successfully completed on December 26th last, and was a valuable addition to the means of communication with South America. It was right to note that they had now a new competitor in South America, for the German cable between the Canary Islands, West Africa and Pernambuco was opened in March last, but sufficient time had not yet elapsed to enable them to ascertain the effect of this competition. No further progress had been made since their last meeting with regard to the projected cable between the island of Ascension and Rio de Janeiro, but they must be prepared to carry this out at short notice, and the estimated large expenditure would, of course, be met from the reserve fund. Touching the position of their reserve fund, he might point out that in the last few years, their great enterprise of laying a direct cable from St. Vincent to Argentina had necessitated an expenditure of about £950,000, and that there could be no doubt that in a similar manner they would have, though at less expense, to strengthen their communication with Brazil, whether it be *via* Rio direct or Pernambuco. Such demands as these on the resources of the company were very heavy, but they were demands which must be met, if, on the one hand, they were to maintain their cable service in a condition to be adequate to their responsibilities to the public, and so to ensure as far as possible the stability of their dividends and the steady value of their shares. Facts such as those alone abundantly justified the policy of the board in placing large sums to their general reserve; but they had also to remember that the replacement of their existing cables as they became old, would always necessitate the expenditure of money at periods, and to an extent which could not with any certainty be foreseen. Such expenditure, when it amounted to anything beyond ordinary maintenance, could not be charged against revenue without causing violent fluctuations in the amount available for dividend, or else it would necessitate the periodical raising of fresh capital, which might be most inconvenient, besides being bad in principle. Any such state of things could not be advantageous to the stockholders, and would compare prejudicially with the practically stable dividends and steady price of their shares, to which they were proud to point as having existed for so many years. These views were, of course, not new, but he had lately received letters from some valued shareholders urging on them the opposite policy of paying larger dividends and contributing less to the reserve fund. As their criticisms affected not merely their own, but the interests also of the whole body of shareholders, he had thought it right to make the above observations on the well-considered policy of their directors, which had been from time to time emphatically endorsed at several of their general meetings, and which he ventured to think would once more commend itself to their judgment.

Sir J. Denison Pender, K.C.M.G., seconded the resolution, which was carried unanimously.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Bell Telephone Co. of Canada, Ltd.—$850,000 5 per cent. bonds, 1925 (Nos. 7,151 to 7,550 of $500, 4,901 to 5,500 and 6,001 to 6,050 of $1,000 each (London issue).

British Insulated and Helsby Cables, Ltd.—£200,000 5 per cent. mortgage debenture stock.

And to allow the following securities to be quoted in the Official List:—

Bell Telephone Co. of Canada, Ltd.—$4,049,000 5 per cent. bonds, 1925 (issued abroad).

Kaministiquia Power Co., Ltd.—$2,000,000 capital stock in shares of $100 each.

Traction and Power Securities Co., Ltd.—The report states that the profit for the year to December 31st was £26,482, plus £5,623 brought forward. The directors have applied £1,920 to writing down certain securities, and have transferred £25,000 to investment reserve account, leaving £5,185 to be carried forward. The Clyde Valley Electrical Power Co. continues to make good progress; the gross revenue and the profit for 1910 much exceed those of any previous year. The earnings of the Mersey Railway Co. for 1910 again showed an increase. The engagements of the Société Electrique Westinghouse de Russie in connection with the contract guaranteed by this company have been fully met. The annual meeting of the company was held yesterday.

MARKET QUOTATIONS.

Wednesday, May 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£12 10	..
a Copper Sulphate	"	£20	..
a Lead, Nitrate	"	£24	£1 dec.
a " White Sugar	"	£22 15	..
a " Peroxide	"	£23	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a " Chlorate	per lb.	8½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70 %) ..	"	£11	..
a " Chlorate	per lb.	8½d.	..
a " Crystals	per ton	£5 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a " Cyanide (basis 100 %) ..	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	£5 dec.
b " Wire, in ton lots ..	"	£102	..
b " Sheet, in ton lots ..	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6¾d.	..
c " Tube (brazed)	"	8¾d.	..
c " " (solid drawn) ..	"	6¾d.	..
c " Wire, basis	"	6¾d.	..
c Copper Tubes (brazed)	"	8¾d.	..
c " " (solid drawn ..	"	8¼d.	..
c " Bars (best selected) ..	per ton	£69	..
c " Sheet	"	£69	..
c " Rod	"	£69	..
c " (Electrolytic) Bars ..	"	£56 15	5/- inc.
c " " Sheets ..	"	£72 10	5/- inc.
c " " Rod ..	"	£60	5/- inc.
c " " H.C. Wire	per lb.	7½d.	¼d. inc.
f Ebonite Rod	"	5 8	9d. dec.
f " Sheet	"	4 9	9d. dec.
n German Silver Wire	"	1/11	..
b Gutta-percha, fine	"	8/6	..
b India-rubber, Para fine	"	4/5½	5½d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	61/10½	1/1½ inc.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£18 2 6 to £18 7 6	3/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	15/- dec.
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d " " " medium	"	2/6 to 4/-	..
d " " " large ..	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/0½	..
p " " rolled strip & sheet	"	1/1	..
o Platinum	per oz.	1£6/6	..
e Silicium Bronze Wire	per lb.	5½d.	$\frac{1}{16}$d. inc.
r Steel Magnet, in bars	per ton	£65	..
g Tin, Block (English)	"	nominal	..
n " Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£19 10	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Doulton & Co., Ltd.—The report states (says the *Financier*) that the accounts for the year 1910, after providing for debenture interest and writing £500 off goodwill, show a debit balance at revenue account of £21,846, as against a debit balance of £16,010 last year.

STOCKS AND SHARES.

Tuesday Evening.

AMONGST the very few markets in the Stock Exchange which have been really active during the past week or so is that in which are negotiated the bonds of various Mexican and Canadian and allied Companies. Besides electric light and power, many other issues are hailing from groups linked with these, and there is a good deal of quite noticeable appetite on the part of the public even for speculative ventures to which the term "bond" is attached. He need not be a great purist who would find fault with the loose way in which the term is applied to many of the securities issued nowadays, but this, as Kipling would say, is another story. So far as the electrical industry is concerned, most of the bonds which have been introduced during the past few years may now be said to have a substantial backing of security, although, when they were issued, this was, in certain instances, some way removed from the facts.

The Home Railway market continues to occupy a fair amount of public interest, in which the underground divisions have had a good share. The remarkable fluctuations in London General Omnibus stock have caused a good deal of attention to be paid to the London undertakings generally, and as it is understood that the threatened Premier Company has been permanently shelved, the disposition revived to buy transportation issues. Metropolitan Consolidated rose ¾, although Districts slipped back ¼. City and South London lost ½, but the Preference stocks are better. Central London Deferred rose 1 on the day that the Shepherd's Bush Exhibition was opened. The fact that the latter is advertised as already complete is taken as a bull point for the Central London trio, while the success attendant upon the opening of the Festival of Empire at the Crystal Palace assisted to maintain the firmness which characterised Brighton Deferred stock until tired bulls started selling again and lowered the price. East London Ordinary have been down to 6⅞, picked up to 7⅛, and reacted to 7⅛; the Debenture stocks were also rather harder, the prospect of electrification being dealt with in practical fashion before very long bringing in a few buying orders which had their effect.

The Telegraph Market is quiet, and apart from irregular movements in Anglo-Americans, the changes are mostly in the upward direction. There are, however, not many of these. Great Northern Telegraphs continue to improve, and Reuters rose ⅛ on the assumption that the company should be amongst those which stand to gain materially on the Coronation and other celebrations. Eastern Ordinary and Eastern Extensions have weakened. Marconi Wireless shares, after their 5s. rise of last week, put on another 2s. 6d., bringing the price up to 32s. 6d. middle. The support comes chiefly from Dublin and other Irish centres, where the progress of the company seems to make very considerable appeal.

National Telephone Deferred touched 130, went back to 126, and then hardened to midway between these figures; while the third preference have given way a trifle. Movements now are caused almost entirely by speculative dealings, although at this eleventh hour there are people who write to their brokers asking whether it is discreet to buy the Deferred stock by way of investment! New York Telephone bonds are a little better, and Telephone Company of Egypt 4½ per cent. Debentures put on a small fraction.

Amongst the Electricity Supply shares, Brompton Ordinary and Preference, City of London Ordinary, and South Metropolitan Preference have all advances. We are able to state that an issue of £60,000 5 per cent. Debenture stock at 90 is on the point of being made by the Electric Supply Corporation; indeed, the prospectus may be out before these lines are in print. Edmundson's Preference gave way sharply, falling back to 3 on a little selling that came in after the rise. Except for these comparatively few movements, the market has been idle, and business of the most retail description.

The highly-conflicting news from Mexico, which, on one day states peace to have been declared, and on another flatly contradicts it, has had the effect of causing a good deal of activity amongst prices. One day it was reported that the revolutionaries had got possession of Pachuca, and Pachuca bonds receded a little to 90, from which there was a slight recovery. Mexican Trams have recovered 1½, and both classes of bonds gained ½. In the same group, the principal rises have been achieved by Rio Trams and Sao Paulo Trams. Rio Common shares rose nearly 5 points, and each class of bonds hardened up. Sao Paulo has the remarkable rise of 11 points to its credit this week. Judging from the character of the buying, it would seem that some people have a good inkling of what the next dividend is likely to be, and it may be inferred from the movement in the price that an improvement is anticipated. The company, of course, has been publishing wonderful results for some time past, and only the anxiety on the part of the board to place it in a very strong financial position can have stood in the way of a larger increase in the dividend before now. The bonds are a trifle better. Cape Electric Trams hardened up to 12s. 6d. on a renewal of the buying by the same people who took the market in hand some months ago, and it is said that the rise has not yet stopped. Manaos First Debentures continue to improve, and are being steadily bought for investment purposes.

Lively dealings in London United Tramways Preference ran the price up to 4¼, but at this level sellers came in who reduced it again to its present position of 4. The Debenture stock is a shade harder, and the market for these two is more animated than it has been for years past, thanks, of course, to the agreement which the company has arrived at with the group that has the London General Omnibus and Underground Railways Combine in hand. Metropolitan Electric Tramways have risen, and the general tone in this section is quite firm. Amongst the industrial shares, Edison and Swan lost part of their recent rise, and fell back to the extent of $\frac{3}{32}$. Castner-Kellner are also a little easier. Electric and General Preference at 4¼ are the fraction up.

The Rubber market took a turn for the better in the early part of the week upon the appearance of one or two company reports showing that directors are by no means eager to pay sensational dividends at the expense of good finance. The position of raw rubber, however, still excites a good deal of confusion, and nobody seems to know what is going to happen next. After the long fall experienced in the leading shares, it is perhaps only natural that there should be some sort of support; though, at the same time, it must be confessed that the share market remains in a tender and somewhat nervous condition.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 23rd.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8¼ — 8⅝	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	9¼ — 9⅝	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅝ — 10¾	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	102 —104	..	4 6 7
Brompton & Kensington, Ord.	5	10	10	7⅜ — 8⅛	+ ⅛	6 1 3
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8	+ ⅛	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —103	..	3 17 8
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 17 4
Do. " City Undertaking " 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Chelsea, Ord.	5	4†	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	100 —102	..	4 8 3
City of London, Ord.	10	7	7	11¾ — 12¼	+ ⅛	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	92 — 94	..	5 6 5
County of London, Ord.	10	5	5	7⅝ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	10⅝ — 11⅜	..	5 7 5
Do. 4½ % Deb.	Stock	4½	4½	109½ — 111½	..	4 0 9
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — 1	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2¼ — 3½	— ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4⅜ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4¼ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7¼	..	6 11 0

NAME.	Stock or Share.	Dividends for		Closing Quotations May 23rd.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Kensington & Knightsbridge, Ord	5	8	9	7 — 7⅞	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅞ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	5	5	3⅞ — 4¼	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4¾	..	4 16 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 89	..	3 18 8
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97 — 99	..	4 10 11
Newcastle-on-Tyne	5	4	4	3¾ — 4¼	..	4 14 2
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	95 — 97	..	5 3 1
Notting Hill	10	7½	8	12 — 12⅝	..	6 5 6
Oxford	5	7	7½	6 — 6⅝	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	3 — 3½	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	101 —104	..	4 16 2
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1¼	+ 1/16	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	3½	3½	⅞ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3½	2½ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	— ⅛	5 4 4
Calcutta, Ord.	5	8	7†	7 — 7⅛	— ⅛	5 6 8
Do. 5 % Pref.	5	5	5	4⅝ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	6	6	111 —114	..	5 5 3
Do. 7 % Pref.	$100	7	7	120 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	..	6	13/16 — 15/16	..	6 8 0
Do. 5 % Deb.	100	5	5	92 — 95	+1	5 5 3
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	97½ — 99½	..	6 0 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83½ — 85½	—1	5 17 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 1/32	..	..
Do. 6 % Pref.	1	6	6	13/16 — 15/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 3
Madras, Ord.	5	Nil	Nil	3 — 3½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	94 — 96	..	5 4 9
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½ — 90½	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	85 — 87	+3½	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	108 —110	+2½	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 96	+ ½	5 4 2

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ - 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	..	8	154 —157	+ ½	5 1 11
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	71 — 73	..	6 17 0
River Plate, Ord.	Stock	9	10	218 —228 xd	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114 xd	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	104 —106	..	4 15 8
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	114 —117	—1	4 5 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108½ —110½	..	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	102 —104 xd	..	4 6 7
Toronto Power, 4½ % Deb.	Do.	4½	4½	101 —103	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	+1	5 5 3
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	— 1/32	Nil
Do. (new)	1	..	Nil	15/16 — 1	..	Nil
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	+ ½	4 19 0
American Telep. & Teleg., Cap.	$100	8	8	152 —154	+ ½	5 3 11
Do. Collat. Trust	$1000	4	4	95½ — 97½	+1	4 2 1
Anglo-American Telegraph	Stock	3⅜	3½	69 — 71	— ½	5 5 8
Do. 6 % Pref.	Do.	6	6	113¾ — 114¾	— ¼	5 4 7
Do. Def.	Do.	25/-	30/-	26⅜ — 26⅝	..	5 11 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 1/16 — 7 5/16	..	5 11 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	88 — 90	..	4 8 11
Cuba Telegraph	10	6	6	9¼ — 10¼ xd	..	5 17 1
Do. 10 % Pref.	10	10	10	17 — 18 xd	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅝ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100½ — 102½	..	4 8 8
Direct United States Cable	10	4	5	7⅝ — 8⅛	..	6 3 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	137½ — 140½	+ ½	4 19 8
Do. 3½ % Pref. Stock	Do.	3½	3½	84½ — 86½	..	4 0 11
Do. 4 % Mort. Deb.	Do.	4	4	100½ — 102½	..	3 18 1
Eastern Extension	10	7	7	13⅝ — 14⅛	+ ⅛	4 19 1
Do. 4 % Deb.	Stock	4	4	101 —103	+ ½	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ — 101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	11 — 11½	..	5 2 2
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 9
Great Northern Telegraph	10	18	18	31½ — 32½	+ ½	5 9 11
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4½	5	93 — 96	..	5 3 1
Do. 4 % Cum. Pref.	$100	4	4	78 — 80	..	5 0 0
Marconi's Wireless Telegraph	1	Nil	Nil	1 3/16 — 1 1/16	+ ⅛	Nil.

Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —105	..	5 14 3
Do. Def.	Do.	6	6	127 —129	+ ½	4 13 0
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	+ ⅛	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 7/16 — 5 13/16	— 1/16	4 7 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 2
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 —100	+ ½	4 10 0
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5	8¼ — 8⅝	+ ⅛	4 11 5
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 9 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	+ ½	4 8 3
United River Plate Telephone	5	8	6†	7⅜ — 7 13/16	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1¼ — 1½	..	..
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99½ — 101½	..	3 18 10
West India and Panama Teleg.	10	Nil	½	2⅜ — 2⅝	..	1 18 1
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10¾	..	5 10 4
Do. 6 % Cum. 2nd Pref.	10	14½	..	9⅜ — 10⅜	..	5 18 5
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	7	13⅜ — 14¼	+ ⅛	4 19 1
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 18 10
Western Union Tel., 4% Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	98 —101	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations May 23rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	¼ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 7/16	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1¼	— ¼	Nil
Do. 6 % Pref.	10	3	..	4½ — 4¾	— ¼	..
Do. 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	76 — 78	..	3 16 11
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	67 — 69	+1	2 18 0
Do. 4 % Deb.	100	4	4	104 —106	+2	3 15 6
City & South London, Ord.	100	1¾	1½	34½ — 35½	— ½	4 4 6
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —106	+2	4 14 4
Do. Do. 1903	100	5	5	103 —106	+1	4 14 4
Do. 4 % Deb.	100	4	4	101 —103	+1	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	12½ — 13½	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	¾ — 1¼	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1½ — 2	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¾	2⅜	2¼ — 2⅝	+ 1/16	4 10 11
Do. 4 % Deb.	100	4	4	79 — 84	..	4 15 3
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	98 —100	..	4 0 0
London United Trams, 5 % Pref.	10	Nil	Nil	3⅜ — 4¼	..	Nil
Do. 4 % Deb.	100	4	4	77 — 80	..	5 0 0
Metropolitan Railway Consol.	100	1	1⅜	51¾ — 52¼	+ ¾	2 12 1
Do. Surplus Lands	100	2⅜	2⅜	66 — 68	..	4 0 11
Do. 3½ % Deb.	100	3½	3½	93 — 95	..	3 13 8
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	32½ — 33	..	Nil
Do. 6 % Deb.	100	6	6	148 —150	..	4 0 0
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Do. 4 % Prior Lien	100	4	4	102 —104	..	3 16 11
Do. 4½ % First Pref.	100	..	3⅜	89 — 91	..	3 11 5
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	5	5½	⅞ — 1	+ 1/16	5 10 0
Do. Def.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	2⅝ — 1 3/32	+ 1/32	4 17 0
Do. 4½ % Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 5 % Deb.	100	5	5	100 —103	..	4 17 1
Potteries, Ord.	1	2	..	1/32 — 3/32	..	..
Do. 5 % Pref.	1	5	5	3/32 — 5/32	..	6 19 2
Do. 4½ % Deb.	100	4½	4½	86 — 89 xd	..	5 1 2
South Metro. Trams, 6 % Pref.	1	3	..	1/32 — 3/32	..	..
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Underground Elec. Railways 5 % Prior Lien	..	5	5	100 —101	..	4 19 0
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	10/-	64 — 66	+1	0 15 2
Do. Power House Debs.	100	..	4	100 —102	+1	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/16 — 1/8	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	..
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 2nd Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4 % Deb.	100	4	4	95 — 97	+2	4 2 6
Do. 4½ % Deb.	100	4½	4½	101 —103	+1	4 7 5
Do. 5 % Deb.	100	5	5	103 —105	+ ½	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104½ —106½	..	4 13 11
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝ — 11⅛	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96⅞ — 98⅞	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	98 —100	+1	5 0 0
Brisbane Trams Invt., Ord.	5	8½	8†	6⅜ — 6⅝	..	6 5 11
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	146 —150	..	5 6 8
Do. Pref. Ord.	100	6	6	126 —129	..	4 13 0
Do. 5 % Pref.	100	5	5	109 —112	+1½	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101 —103	..	4 13 9
Calcutta Trams, Ord.	5	4⅜	5	5⅛ — 6	..	4 3 4
Do. 5 % Pref.	5	5	5	5⅛ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	101 —104	..	4 6 7
Cape Electric Trams	1	Nil	Nil	9/16 — 11/16	+ 1/16	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜ xd	..	4 5 1
Do. 4 % Deb.	100	5	5	96 — 99	..	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100⅜ —102⅜	+1	4 17 7
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	94 — 97	..	5 3 1
Do. 6 % B Deb.	100	6	5	66 — 70	..	7 2 10
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	1⅛ — 1⅜	..	6 8 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	98 —102	..	4 18 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	94 — 97	+1	5 3 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com.	$100	6	7	124½ —127½	+ 1½	5 9 10
Do. Gen. Con. 5 % Bonds	..	5	5	96⅞ — 97⅞	+ ⅜	5 2 4
Do. 6 % Bonds	100	6	6	102¼ —103¼	+ ⅜	5 16 3
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅜ — 7⅝	— ⅛	6 11 2
Do. 6 % Pref.	5	6	6	5⅞ — 6⅛	..	5 2 2
Do. 5 % 1st Deb.	100	5	5	99 —101 xd	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 1/8	..	2 13 4
Do. 5 % 1st. Deb.	100	5	5	104 —106	..	4 14 4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	99 —102	..	4 8 3
Rio de Janeiro Trams	$100	2	5	112¾ —113¾	+1¼	4 7 11
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	+ ¼	4 16 2
Do. 5 % Mort. Bonds	100	5	5	96 — 97	+2	5 3 1
Sao Paulo Tram, Lt. and P.	$100	10	10	178 —180	+11	5 11 1
Do. 5 % 1st Deb.	$500	5	5	105 —106	+1	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	82 — 86	..	5 16 3
Southern El. Tr. B.A., 5 % Deb.	..	5	5	97 — 99	+1	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5⅛ — 6⅛	..	5 7 8
Do. 6 % Pref.	5	6	5	5 — 5⅛	..	4 10 11
Do. 5 % 1st Deb.	100	5	6	101 —104	..	5 15 5
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105 —107	..	4 4 1

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	..	0 — 1/16	..	..
Do. 6 % Pref.	1	12	9	15/16 — 1 1/16	..	7 2 0
Babcock & Wilcox	1	24	20†	5⅛ — 5⅜	+ 1/16	4 6 4
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/8 — 3/16	..	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5 0
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	Nil	0 — 1/16	..	Nil
Do. Pref.	1	Nil	Nil	1/16 — 1/8	..	Nil
Brush, Ord.	1	Nil	Nil	14/6—15/6	..	Nil
Do. Pref.	2	Nil	Nil	1/16 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 3/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	41 — 46	..	9 15 7
Callender's Cable	5	15	10†	9⅜ — 9⅝	..	7 13 5
Do. Pref.	5	5	5	5⅛ — 5⅜	..	4 17 7
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
Castner-Kellner	1	17½	7½†	31⅜ — 31⅞	— 3/32	4 19 2
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	Nil	1/8 — 3/16	..	Nil
Do. Deb.	100	5	5	70 — 80	..	6 5 0
Dick, Kerr	1	5	6	⅞ — 1	..	6 0 0
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	Nil	13/32 — 17/32	— 3/32	Nil
Do. fully paid	5	Nil	Nil	1/4 — 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	3/32 — 1	..	Nil
Do. Pref.	2	7	7	1/32 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	10¼ — 10⅜	..	6 10 3
Do. Deb.	100	5	5	102 —103⅜	..	4 16 7
General Electric, Pref.	10	5	5	8⅝ — 9	..	5 11 1
Do. Deb.	100	4	4	83 — 88	..	4 10 11
Henley's, Ord.	5	15	15	12⅜ — 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 9
Do. Deb.	100	4½	4½	108 —110	..	4 1 10
India-Rubber, G. & T.	10	10	10	16¼ — 17	..	5 17 8
Do. Pref.	10	5	5	10¼ — 10⅜	..	4 14 1
Telegraph Construction	12	17½	20	36⅜ — 38⅜	..	6 5 0
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	Nil	⅛ — ¼	..	Nil
Do. Pref.	5	3	Nil	3/16 — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1911.

Both the exports and imports, but more particularly the former, show decreased totals as compared with the March returns.

The exports reached £310,764 in value (inclusive of £21,834 worth of telegraphic material), and this compares with a total of £421,327 in the previous month and some £59,000 of telegraphic exports. The decreased total can be largely accounted for by the reduced machinery and cable exports, the former being some £50,000 and the latter nearly £20,000 down, as compared with the previous month's figures.

The import total of £225,138 compares with £240,135 in March; and with the exception of machinery and lamp imports, a general reduction in value is apparent under the various headings.

The re-exports reached £25,176, the highest value recorded since August last.

Japan, India and New South Wales were our best customers during the month, in the order mentioned, while of the importers into this country, Germany's total of £156,151 places her a long way ahead of all others, even though allowance is made for "reconsigned" goods, manufactured in Austria-Hungary, Switzerland, &c., which are unavoidably included in this total.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	440	1,176	101	91	161	2,596	1,283	6	...	195	43	6,092
Germany and German West Africa	383	283	45	404	820	1,096	15	2	...	64	250	3,362
Netherlands, Java and Dutch Indies	280	2,169	63	21	63	1,869	...	...	...	67	7	4,539
Belgium	303	1,485	247	125	19	4,219	25	3	...	2,631	451	9,508
France	1,028	95	171	103	45	1,460	655	18	...	101	1,240	4,916
Portugal	...	81	...	26	...	84	...	...	11	88	127	417
Spain, Canary Isles and Spanish N. Africa ...	699	...	703	...	394	274	32	6	...	57	30	2,195
Switzerland, Italy and Austria-Hungary ...	875	24	65	14	795	5,608	10	62	...	1,826	30	9,309
Greece, Roumania, Bulgaria and Turkey ...	446	52	...	365	...	525	...	296	16	21	18	1,739
Channel Isles, Gibraltar, Malta and Cyprus ...	40	307	70	33	81	102	...	84	...	9	339	1,065
U.S.A. and Philippines	39	...	485	371	423	1,368	...	10	499	24	160	3,379
Canada and Newfoundland	652	1,067	464	1,103	1,131	3,092	...	1,141	70	7	523	9,250
British West Indies and British Guiana ...	80	10	47	56	...	132	...	15	40	90	...	470
Mexico	70	123	56	20	...	400	...	6	...	1,115	296	2,086
Peru and Uruguay	344	243	236	48	...	1,343	...	26	...	86	199	2,525
Chile	385	267	26	25	88	1,966	...	61	11	405	186	3,420
Brazil	370	3,483	343	542	114	7,232	...	8,703	...	2,357	2,652	25,796
Argentina	1,769	3,093	585	290	374	8,117	2,441	747	...	1,734	5,161	24,311
Colombia, Venezuela and Bolivia	50	...	...	...	...	693	...	97	...	1,173	...	2,013
Egypt, Tunis, Morocco and Persia	221	130	152	13	2	950	115	128	...	18	374	2,108
British West Africa and St. Helena	3	319	2	32	129	449	...	47	24	157	569	1,731
Rhodesia and Transvaal	2,435	1,272	311	825	29	4,867	...	167	65	3,199	783	13,953
Cape of Good Hope	1,037	5,306	191	612	281	994	634	581	16	108	161	9,921
Natal	652	7,055	200	172	26	1,701	1,248	2	16	30	31	11,133
Zanzibar, Brit. East Africa, Mauritius & Aden	32	11	62	145	4	15	...	14	18	50	188	539
Azores, Madeira and Portuguese Africa ...	133	2,879	55	17	57	398	...	5	...	13	179	3,736
French African Colonies, Madagascar and French Indo-China	66	54	79	10	21	936	...	3	...	12	12	1,193
China and Siam	522	1,576	1,155	331	1,029	976	69	72	9	145	48	5,932
Japan and Korea	1,142	1,858	206	...	2,285	10,116	7,606	70	...	10,966	1,032	35,281
India	2,642	9,535	2,590	1,594	511	5,387	1,557	2,079	247	2,662	1,227	30,031
Ceylon	91	480	105	233	16	321	968	34	...	43	35	2,326
Straits Settlements, F. M. States and Sarawak	413	763	302	214	37	551	102	569	42	107	244	3,344
Hong Kong	520	492	76	346	157	310	32	54	...	4	707	2,698
West Australia	243	397	43	30	131	2,903	...	32	...	1,902	2,225	7,906
South Australia	486	131	48	...	868	1,025	...	42	11	550	24	3,185
Victoria	1,495	4,757	386	1,012	73	1,849	...	331	...	3,727	785	14,415
New South Wales	1,960	4,211	1,658	215	374	9,345	334	2,304	111	8,826	316	29,654
Queensland	238	998	240	409	...	2,910	8	...	...	2,571	95	7,469
Tasmania	29	19	6	...	...	37	...	448	...	...	57	596
New Zealand and Fiji Islands	1,182	1,145	559	833	48	1,369	...	477	22	561	1,030	7,226
Total, £	23,795	57,346	12,133	10,680	10,586	89,585	17,134	18,742	1,228	47,701	21,834	310,764

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	...	...	...	160	...	2,072	180	404	126	5,703	8,645
Germany	343	5,121	1,798	31,548	1,324	90,766	653	761	5,301	18,536	156,151
Holland	47	381	8	1,855	...	16	...	...	15	...	2,322
Belgium	252	1,586	26	68	156	1,600	46	466	350	4,647	9,197
France	219	38	643	2,133	519	445	231	769	2,755	9,371	17,123
Switzerland	153	81	84	32	...	777	...	...	7	16	1,150
Italy	50	819	...	3	...	20	...	...	...	4,532	5,424
Austria-Hungary	...	655	...	1,670	15	20	...	...	267	124	2,751
United States	4,129	...	344	393	102	8,492	7,207	154	111	964	21,896
Total, £	5,193	8,681	2,903	37,862	2,116	104,208	8,317	2,554	8,932	43,893	224,659

Additional imports: Spain, carbons, £846; Canada, goods, £133.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	5,893	1,449	...	2,277	...	2,911	...	219	504	11,923	

Total Exports: £310,764. Total Re-Exports: £25,176. Total Imports: £225,138.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

DAY LOADS FOR CITY ELECTRIC LIGHT AND POWER STATIONS.—II.

Electrolytic Hypochlorite for Laundry and Bleaching Purposes.

By JOHN B. C. KERSHAW.

Although the time has not yet arrived when one-half the world lives by "taking in the washing" of the other half, a much larger proportion of all city populations in civilised countries is engaged in cleaning, bleaching and laundry occupations than is generally recognised, and the last census returns, when analysed, will probably show that in the United Kingdom this proportion of the population is rapidly increasing. Laundries and the so-called dry-cleaning works multiply and increase in size with astonishing rapidity. The up-to-date central station manager should find, therefore, among these laundries and dry-cleaning works (many of large size) a profitable and useful outlet for electric energy. Apart altogether from the question of equipping these works with electrically-driven in place of hand or steam-driven machines, there is the possibility of installing electrolytic bleaching apparatus, which will enable cleaner and whiter goods to be produced than with ordinary bleaching agents, without any great increase in the cost of treatment, and with less destructive effects upon the fabrics.

The practical use of electrolysis to produce bleaching solutions dates from 1890, when a Frenchman named Hermite introduced his process at a wood pulp factory at Stjernfors, in Sweden. Since that date a very large number of cells for producing hypochlorite by the electrolysis of brine have been patented and tried experimentally. In the writer's monograph upon "The Electrochemical and Electrometallurgical Industries of England," published in 1907 by Knapp, of Halle, as Vol. XXVIII of the German series on applied electrochemistry, much information will be found relating to the electrolysers of Watt, Hermite, Vogelsang, Atkins, and Woolf, and to the practical trials that had been made with these in the years 1890-5 in the United Kingdom. These early attempts to apply electrolytic hypochlorite to various bleaching or deodorising purposes failed, chiefly owing to defects in the apparatus, and it is only within the last few years that success has been attained in producing a satisfactory apparatus, and a fairly stable bleaching fluid, at a reasonable cost. It is claimed for the sodium hypochlorite produced by the electrolysis of brine that its efficiency as a bleaching agent is much higher than that of calcium hypochlorite (the active agent of "bleach" or "chloride of lime"), while its destructive action in weakening the fibre of the goods, is less. As regards the superior bleaching efficiency of the electrolytic solution, Drs. Kind, Weindel, and Fraas, have investigated the somewhat exaggerated claims made on its behalf, and find that—

1. Using equal amounts of chlorine, and working under similar conditions, the electrolytic bleaching liquor gives the better bleaching effect.

2. If the bleaching effect be stopped at the same degree of whiteness, the use of electrolytic liquor enables a saving of 5 per cent. of chlorine to be made when working with alkaline liquor.

3. The presence of an excess of bleaching liquor does not alter these comparative results.

4. Increase of alkalinity diminishes the rate of bleaching, but increases the final effectiveness of the bleach in the case of both electrolytic and "bleaching powder" solutions.

In the light of these conclusions, central station managers have a good case to present when urging the adoption of electrolytic methods of preparing the bleaching solutions required by laundries and cleaning works. The information given in what follows respecting the chemistry of the electrolytic process and the details of construction of two forms of apparatus which have received practical trial in laundries and bleaching works, would prove useful to those who may attempt to canvass possible customers on this subject.

1. *Theory of the Electrolytic Hypochlorite Cell.*—The electrolysis of solutions of chlorides always produces chlorine at the anode, and the hydrate of the base (sodium, potassium or magnesium) at the cathode. In the electrolytic alkali processes, the aim of the inventor has been to effect removal of these products before they can react one with the other. In the electrolytic bleaching processes, the chlorine and the caustic hydrate are allowed to react, in order that the chemical changes represented by the following equations may occur—

$3NaOH + 3Cl = 3NaOCl + 3HCl$ — Sodium hydrate and chlorine yield— Sodium hypochlorite and hydrochloric acid.

$3NaOH + 3HCl = 3NaCl + 3H_2O$ — Sodium hydrate and hydrochloric acid yield— Sodium chloride and water.

If the temperature be allowed to rise above a certain point, a further action will occur, and chlorate will be produced. It is, therefore, necessary in all electrolytic bleaching and disinfecting processes to pay great attention to the temperature, as chlorates are useless for bleaching purposes.

2. *The Siemens Electrolyser.*—This form of hypochlorite cell is based on the patents of Dr. Karl Kellner, of Vienna, one of the early workers in applied electrochemistry. The following description is taken from the article which appeared in the *Chemical Trade Journal* for March 27th, 1909:—

The Siemens "bleaching electrolyser" consists of a flat tank of substantial construction, divided into sections by vertically arranged glass plates. By this means a series of decomposition cells is formed: these are "pitched" in such a manner that the solution of salt or bleaching lye must flow horizontally in a zig-zag path from cell to cell, and is subjected in each cell to the action of the electric current. This arrangement permits of making bleaching electrolysers for connection to any continuous-current supply at any voltage, but it is advisable not to use more than 150 volts.

The electrodes are constructed of platinum-iridium wire net, and are arranged horizontally one above the other in such a manner that the anode (positive electrode) lies below the cathode (negative electrode). This arrangement causes layers of fluid to be formed in the electrolyte, and effects the most efficient utilisation of the electrical energy. The electrodes are so arranged that no internal electrical connections of any kind are necessary. This is a great practical advantage, as connections to electrodes are well known to give considerable trouble. The Siemens electrolyser has only two current terminals, which have been designed as a result of special experience, and are built into the apparatus in such a manner that it is impossible for them to be attacked by electrolytic action. The electrodes are so arranged that they can be taken out of the electrolyser at any time for purposes of adjustment, and replaced quickly.

The fitting up and working of a modern electrolytic bleaching apparatus of the Siemens type is extremely simple. The necessary quantity of salt is dissolved in water in a vessel, and the solution is then allowed to clarify in a second vessel; for this purpose wooden vats or tanks of brickwork, &c., are used, or the existing tanks employed for dissolving chloride of lime are generally suitable. The clear solution of salt passes into a cooling vessel, whence it is forced continuously through the electrolytic apparatus by means of a small centifugal pump. In the course of this circulation the solution of salt is gradually decomposed by the electric current, and the bleaching lye, in passing through the above-mentioned cooling vessel, is kept cool by means of coils of lead pipes through which water is passed, and is thus maintained at the low temperature necessary for a good output. The circulation continues until the desired concentration of active chlorine has been attained.

This type of hypochlorite cell has attained extended use in Germany and Austria for laundries and chemical cleaning works.

3. *The Haas and Oettel Electrolyser.*—This electrolyser is distinguished from that of Kellner by the use of carbon as electrode material, and by the application of the hydrogen gas liberated at the cathode, to effect automatic circulation

of the liquid in the vessel containing the mixed brine and hypochlorite solutions. The description is taken from an article by E. Reuss, appearing in the issue of this paper for April 15th, 1910.

The electrolyser consists of a rectangular stoneware box, divided by the carbons into some 30 compartments, each chamber having a hole at the bottom and another at the

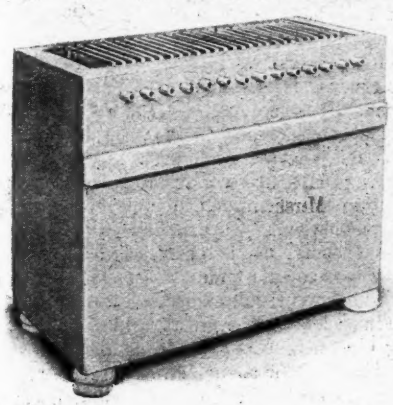


Fig. 1.

side, about 2 in. from the top. The first and last carbons in the set form respectively the anode and cathode. (See fig. 1.)

The electrolyser is placed in a stoneware tank, measuring about 6 ft. long × 4 ft. wide × 3 ft. deep, and this is filled with brine holding about 15 per cent. of common salt in solution. As soon as the circuit is completed, a lively effervescence commences in the cells, due to the evolution of hydrogen, which raises the level of the liquid inside the electrolyser, causing it to overflow through the openings at the sides, while it is replaced by fresh liquor entering through the holes in the bottom of the cells.

As the passage of the current produces heat, the temperature is kept down by passing cold water through coils placed on either side of the electrolyser. The circulation is entirely automatic and is very effective.

Continuous current is employed, at about 80 amperes and 110 volts, and it requires some 10 hours to complete the electrolysis. Thus about 88 kw.-hours of energy are consumed, the output in chlorine at the end of the operation being 10·5 kg., or the equivalent of about 80 lb. of bleaching powder.

A very large number of the Haas and Oettel electrolysers are now in use for laundry purposes in England and America, and the writer has inspected a similar installation, which is giving satisfaction, at a large dyers' and cleaners' works in the vicinity of Liverpool.

Figs. 2 and 3 show working installations of this electrolyser.

4. *The Hermite Electrolyser.*—An improved form of the Hermite hypochlorite cell has been in use since 1905 by the sanitary authorities at Poplar, London, for manufacture of a disinfecting fluid, and although the writer has no definite knowledge that this cell has been applied in laundry and bleaching work, it will be useful to include a description of it in this article. A mixture of sodium and magnesium chloride is used as electrolyte, and sodium hydrate is added to the solution as it leaves the cell as a preservative. The description is taken from a paper by C. V. Biggs, read before the Faraday Society in November, 1906.

The system adopted at Poplar is to mix a certain quantity of fluid in an elevated tank, and then to allow this fluid to flow through four double troughs or cells, placed one above the other, so that the liquid descends continuously by gravity. Each trough is divided laterally by a partition, and in each of the two divisions, five distinct "elements" (consisting of one positive and two negative plates) are suspended. The positive plates are of thin platinum wire, wound upon slate slabs, the negative plates are of zinc. There are thus four troughs, each containing 10 "elements," or 40 cells in all. The liquid enters through a funnel, passes along the front division of the top trough, back through the division behind, over a weir and into a subdivision, from which it is drawn off by a bent glass tube discharging into the second funnel; it passes along the front division, back through the division behind, over the weir into the pocket of the second trough, and so on to the final bent tube, which discharges it into a carboy. A bottle arranged at the right-hand side of the tier of cells supplies the sodium hydroxide used as a preservative, which flows drop by drop into the carboy as it is filling, and serves to neutralise free hypochlorous acid. As the liquid passes through the troughs it is subjected to the action of a current of 15 amperes at 230 volts, being 5·6 volts per cell.

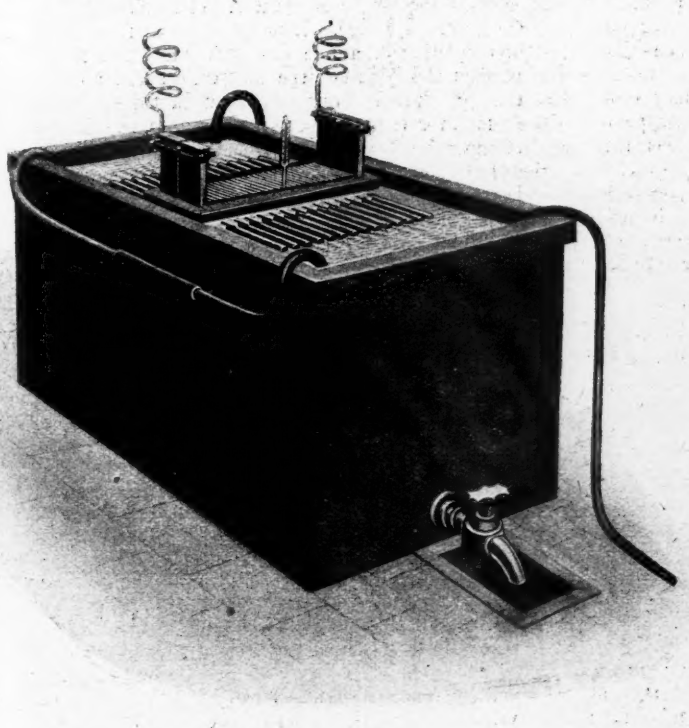


Fig. 2.

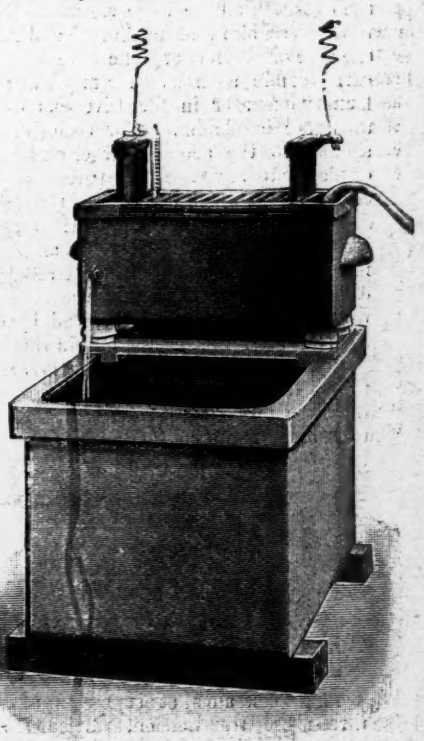


Fig. 3.

Haas & Oettel Electrolysers.

5. *Costs and Conclusions.*—It is unnecessary in this article to examine in a detailed manner the various conflicting data that have been published concerning the comparative costs of bleaching with electrolytic hypochlorite and with ordinary bleaching powder. Independent and unbiased opinion shows that the electrolytic process is rather the more expensive of the two. The present writer, in the discussion upon Mr. Biggs's paper on the Hermite cell, read before the Faraday Society in 1906, made the following statement :—

"For certain purposes, hypochlorite of soda is much to be preferred to hypochlorite of lime, the active agent in ordinary bleaching powder; and in these cases the higher cost of the former, even when produced by the electrolysis of brine, is unlikely to retard its utilisation as soon as a cheap, reliable and durable electrolytic cell for producing it is placed upon the market. The Hermite cell and process in its original form did not fulfil these conditions, and the same judgment must be passed upon many of the patented forms and processes which have since been brought before the public."

The cells described above, however, appear to fulfil the required conditions, as cheap, reliable, and durable cells, for the production of sodium hypochlorite solutions from brine by electrolysis, and as the operation of these cells does not require skilled attention, and can be rendered intermittent by well-known methods, they are eminently suited for installation in laundries and bleach works.

Central station engineers in large towns and cities, in which many hundreds of these laundries and dry cleaning works exist, should, therefore, commence an active propaganda amongst their owners concerning the advantages offered by electrolytic bleaching, and should refer them to the facts that all the large steamship lines are adopting the process, and also that in Europe and America over 600 of one type of electrolyser alone have been sold. The following extract from a circular recently sent out by an up-to-date laundry manager in the Liverpool district may prove of assistance in obtaining new customers of this type, for it shows how the adoption of electrolytic methods may be employed to advertise the particular laundry or cleaning establishment which has adopted them :—

"Knowing that many ladies find it difficult to get their laundry work satisfactorily done, and recognising the great importance of keeping linen entrusted to our care a good colour and free from stains, we are showing special attention to the washing department, and have adopted the latest *electrical process*, being the first in this district to do so.

"This process is quite *a new departure*, and has proved to be by far the best method yet adopted for laundry work; in addition to being *perfectly harmless*, it reduces wear and tear to a minimum and *preserves the linen*, which is unsurpassed for *snowy whiteness*."

REVIEWS.

Three-Phase Transmission. By William Brew, M.I.E.E. London: Crosby Lockwood & Son. Price 7s. 6d. net.

This book aims at supplying a connected account of three-phase transmission, particular attention being paid primarily to such economical and financial points as engineers engaged upon new works would find necessary and useful; and, secondly, to providing students with concrete examples of problems which, whilst demanding scientific treatment, are yet dependent upon commercial considerations for their real solution.

Chapter I is largely introductory, and deals with some figures, &c., relating to extra-high-pressure trunk mains, including the corresponding electrical, financial and legal considerations. The special features of overhead transmission are also entered into clearly. In this section, however, while treating of copper *versus* aluminium conductors, since the book makes a speciality of commercial considerations, it might have been pointed out that copper has a permanent intrinsic value, while the price of aluminium may at some time drop to a very low figure, as the metal has no actual value, being one of the most common constituents of the earth's crust, and its present cost is due merely to its production. Every engineer who has had actual experience of the subject will sympathise with the author in his condemnation of the heartbreaking obstructions raised by the various authorities whose permission is necessary before a high-pressure overhead transmission line can be erected.

Chapter II deals with the various transmission losses and the types of extra-high-pressure generating plant, and gives a very good account, replete with actual calculations, of the limitations of Kelvin's law.

In Chapter III is given a considerable quantity of interesting and valuable data relating to the breakdown strength of paper-insulated cables, variation of dielectric strength with temperature, the corona loss with bare conductors and kindred matters. As regards the latter, the author is well up to date, inasmuch as he gives Prof. Kapp's formula based on Mershon's experiments for the critical potential difference between two parallel wires.

Chapter IV is devoted to the consideration of the control of extra-high-pressure trunk mains. Two typical installations of switchgear are described and illustrated clearly, one representing Continental practice, and one British. The author very rightly lays special stress on the avoidance of rubber-insulated cable connections on the switchboard. The reviewer has seen rubber on the back of a switchboard perish in a remarkably short time—and perished rubber is a really fine combustible material! In this chapter, also, we have an account of bus-bar arrangement, oil switches, relays for various purposes, and a brief description of the Merz-Price protective gear.

Chapter V is more theoretical in treatment than the preceding ones, and deals with the impedance of multi-core cables, resonance phenomena, the effect of harmonics in the generator waves, &c. It might be noted that the frequency of oscillation of a line discharging to earth is quite independent of the size of the line wire and its distance from the ground, and merely depends upon the length of the line. In fact, for the very long lines used in the United States these frequencies almost approach the machine frequency.

In Chapter VI we have an account given of earthing, insulation testing on extra-high-pressure systems, &c.

Various line appliances are treated of in Chapter VII. Lightning arresters receive a somewhat meagre treatment, but possibly the author concurs with the consulting engineer to the General Electric Co., Dr. Steinmetz—one of the greatest living authorities—who is stated to have once remarked that money spent on lightning arresters would be better spent on shifting the transmission line to a district where lightning was less prevalent. In this chapter also the strength of transmission poles and the lines themselves are fully dealt with.

Appendix A gives the somewhat stringent Board of Trade Regulations for overhead wires.

The self-induction of wires in henries per kilometre is given in appendix B, together with a short table of constants for allowing for the current distribution in the conductors.

The electrostatic capacity of wires is given in another appendix C, and a curve for the special case of three-phase cables. In this appendix the units are in microfarads per mile. It would have been better if two sets of formulæ had been given in these appendices, one for the metric system and one for English units. Of course they are easily convertible, but an additional risk of error is introduced, and a serious blunder in the calculation of a large transmission scheme is a calamity of considerable magnitude.

The symbolic method of calculating the regulation, &c., of a transmission line which has been so greatly used and popularised by Dr. Steinmetz is explained in appendix D, and exemplified by numerical examples. The author states that it will be sufficiently accurate for most practical purposes to consider the total capacity as bunched in the midde of the line. Frequently, however, it makes no difference whether the condenser is considered as connected across the line at the generator end, or the receiver end, or at the middle. The best approximation is to consider the line as shunted at the generator and at the receiver end by two condensers of one-sixth the line capacity each, and in the middle by a condenser of two-thirds the line capacity. This approximation, of course, assumes the variation of the

electric quantities in the line as parabolic. For large schemes, however, the reviewer prefers to consider each line element as an infinitely small condenser, and integrate the differential equations based thereon. There is a large amount of labour involved in this method, but, after all, experimenting with mathematical analysis is cheaper than experimenting with actual apparatus.

The book contains a considerable amount of original research, and is not a mere compilation of published scattered articles and papers. It is well got-up, the type, paper and diagrams being exceptionally good. A full index is appended.

In short, the book will be a profitable investment for all transmission engineers and students who are specialising on this important subject.—H. G. S.

The Inventor's Adviser and Manufacturer's Handbook to Patents, Designs and Trade Marks. By REGINALD HADDAN, Fellow of the Chartered Institute of Patent Agents. Eighth Edition. 1911. London: Harrison and Sons.

Comparatively recent changes in the law relating to letters patent in England have turned most of the old text-books on the subject into so much waste paper. Even a consolidation Act, which merely rearranges, but does not alter the law, renders a text-book useless; and upon the passing of such an Act, it is essential that works like that before us shall be recast. As the author states in his preface, the general object and character of the book remain essentially what they were in 1894—when the first edition was published. It was intended to supply inventors, manufacturers and others interested in patents with a full explanation of the causes which sustain or detract from the *value*, as well as the validity, of patented inventions. The principal error that commonly occurs in this country in relation to this subject is the belief that, however the invention may be described, the value of the patent for it will be the same. This is a mistake. The method of patenting has a great influence on the value, separately from the validity of the patent.

The change of practice in 1905 opened up a number of new questions. Many of them have been already canvassed in the Law Courts, and Mr. Haddan has discussed them all in his pages. For instance, at page 50, we find a convenient summary of the important cases decided in relation to the compulsory working section of the Act of 1907.

The importance of a work of this kind to an inventor becomes apparent when one realises the truth of the assertion that the mere grant of a patent means very little. Much depends upon the form in which it is drawn up; more, of course, on the question whether it is valid or not. Prior to 1905 it was the practice in Great Britain to grant any patent asked for, with the result that more than half of the patents that were granted were invalid, to the personal loss of the patentees, as well as to the general confusion and discouragement. This statement (which Mr. Haddan makes) is the result of officially ascertained figures, and although the same state of affairs does not now prevail, it cannot be said that even yet it has been wholly, or even adequately, remedied, since the examination of patent applications before grant only extends to a portion of the field in which anticipations of the invention may be found. The figures are, however, still, and always will be, eloquent of the fact that inventors, as a class, are wont to pursue erroneous methods in obtaining patents. Ignorance of the fundamental requirements of the patent law, or carelessness as to the application of them, has been, and probably will continue to be, the occasion of serious and unnecessary loss to inventors. Unnecessary, because of the patents found to be invalid, five out of six were invalid solely through failure to present a patentable invention in the proper form.

A notable feature of this work, which is continued and elaborated in the present edition, is a complete A.B.C. guide to foreign and Colonial patent law. Possibly some of the paragraphs under this head may remind the reader of the chapter "Concerning Snakes" in "The Natural History of Iceland," the text of which was "There are no snakes in Iceland"; for we read under the heading Bulgaria that "There is no Patent Law" in that turbulent country. But these are just the points with which the patentee wants to be made familiar. Trade marks and designs are also dealt with from a foreign and Colonial point of view; while the appendices contain numerous useful forms in English and in foreign languages.

May we suggest, in conclusion, that in his next edition, the author should complete his work with a table of cases which will make it even more useful than it is at present?

PROCEEDINGS OF INSTITUTIONS.

Physical Society of London.

AT the meeting held on April 28th, a "High-tension Electrostatic Wattmeter" was described by PROF. E. WILSON. When using the electrometer as a wattmeter it is necessary (in order to secure accuracy) that the voltage impressed upon the quadrants shall not be less than a certain minimum, depending upon the voltage to be impressed upon the moving system. When the latter voltage is of the order 10,000, the quadrants require a voltage larger than can economically be provided by a shunt. One is led, therefore, to consider intensifying devices.

The author's quadrature transformer is a very simple piece of apparatus which can be relied upon to give for electrostatic wattmeters an electromotive force which is strictly the differential of the current in the primary winding. The best device to impress on the quadrants a suitable voltage in phase with the current is a generator with an air-cored magnetic circuit as described in the paper. The mains current is passed through the field coil of the generator and produces a magnetic field proportional to the current; the armature is driven at known speed in this field, and is provided with a commutator and brushes. The brushes when set accurately have a voltage between them proportional to, and having the same wave form as, the mains current.

Another device depending upon the charging of condensers in parallel and the placing of them in series has also been used for multiplying a small voltage produced by the passage of the mains current through a low-resistance shunt.

In the discussion, Dr. Sumpner pointed out that the reason why a fairly high voltage was needed on the quadrants together with a strong control on the needle when a very high voltage was applied to the latter, was because of the action between the needle and the case, unless the case was quite symmetrical about the axis of the needle. Mr. E. H. Rayner said that at low power factors various errors in the apparatus would become large, and Mr. C. C. Patterson drew attention to the serious limit of accuracy imposed by not being able to keep the speed constant.

A paper "On the Behaviour of Incandescent Lime Cathodes," by DR. R. S. WILLOWS and MR. T. PICTON, was read by DR. WILLOWS. Wehnelt has shown that incandescent lime emits a large number of negative ions; if, therefore, hot lime is used as the cathode, a discharge may be obtained in a vacuum tube with P.D.'s as low as 30 volts. The alteration with time of these cathodes, under continued use, has been investigated.

A paper "On the formation of Dust Striations by an Electric Spark," by DR. S. MARSH and MR. W. H. NOTTAGE, was read by DR. MARSH. The formation of dust striations by electric spark has been investigated by many observers. The paper attempts to explain their formation as being due to hydrodynamic forces existing between the dust particles while the wave motion is passing over them.

A paper by PROF. E. WILSON and MR. L. C. BUDD on "Previous Magnetic History as affected by Temperature" was taken as read.

At the meeting held on May 12th a paper on "The Method of Constant Rate of Change of Flux as a Standard for Determining Magnetisation Curves of Iron," by Messrs. J. T. MORRIS and T. H. LANGFORD, was read by Prof. J. T. Morris. The research described was instituted with the object of finding what differences there were between the magnetisation curves for a given sample of iron when determined (1) by the older methods, in which the flux is changed suddenly, (2) by a method in which it is changed exceedingly slowly and at a uniform rate. In this method the magnetising current is continuously increased through a primary winding by a specially designed resistance at such a varying rate as to maintain a constant voltage generated in a secondary winding. The complete change of the current occupied times varying from one up to some five minutes.

Tables are given of the magnetisation curve determined by six different methods at a number of values from H 0·3 up to 70·0, and of the permeability from B 500 up to 17,000. At low values of the magnetising force, the uniformly varying flux method gives results some 200 lines per square centimetre in excess of the older methods.

As regards the time required for determinations by the various methods experimentally examined, ballistic methods are undoubtedly the most tedious. The alternating-current method has considerable advantages in this respect, a full set of readings of magnetising current and induced voltage occupying a very short time. When, however, it is necessary to take oscillograms at various

points in order to plot curves of form factors, the time required is enormously increased. The method of uniformly varying flux is peculiarly adapted for use where time is a consideration, and at the same time a high degree of accuracy is desired. A complete magnetisation curve may be taken in a very few minutes, and the mean of many such curves obtained in, say, one hour, the iron being demagnetised after each test.

The method of "uniformly varying flux" appears to possess advantages, both scientific and practical, over the older methods in use for the testing of ring samples of magnetic materials. It avoids difficulties due to eddy currents and magnetic viscosity, which effects are themselves due primarily to rapid or irregular changes of flux Besides rapidity of experiment, it also has the advantage of accuracy of repetition under standard or predetermined conditions of magnetic change.

The PRESIDENT (Prof. H. L. Callendar) gave a demonstration of the action of the electric thermo-regulator designed by him for experiments by the continuous electric method on the specific heat of water in 1897, and described in the "*Phil. Trans.*" A., 1902. The expansion of liquid in a bulb causes a thread of mercury to make contact with a platinum wire actuating a relay which puts a 16-C.P. lamp in series with a 32-C.P. lamp in the regulator tank. If the wire is fixed, hunting occurs, owing to the mercury sticking to the wire, and to lag of the regulator bulb. This is prevented, either by causing the wire to move up and down continually through a distance of about 1 mm. with a period of 5 to 10 seconds, or by fixing the lamp bulb close to the regulator bulb.

The Faraday Society.

HYDRO-ELECTRIC DEVELOPMENTS IN NORWAY.

AT the May meeting of the Faraday Society Mr. A. Scott-Hansen, the distinguished Norwegian engineer, who has himself been closely connected with much of the work described in his paper, lectured to the Society on "Hydro-Electric Plants in Norway and their Application to Electro-Chemical Industries." Mr. James Swinburne, F.R.S., presided over a large audience, which included the Norwegian Minister. The reading of the paper was accompanied by throwing on the screen some 60 or 70 beautiful photographs, which illustrated in a vivid fashion some of the most striking features of the great power centres that are growing up round the Norwegian waterfalls.

The physical configuration of Norway is remarkably favourable for the existance of a type of waterfall that can easily be harnessed for industrial purposes. Close to the sea board, both in the west and south-east coasts, rise lofty chains of mountains which cause the precipitation of enormous quantities of moisture carried by the sea breezes from the Atlantic and the Skagerak. The water so condensed finds its way down the numerous valleys and fjords to the sea, and since some 97 per cent. of the country consists of mountains, moorlands, lakes, and marshes, it is evident that this flow of water represents an enormous quantity of water power, the portion known and available having been estimated at from five to seven million H.P., a figure which Mr. Scott-Hansen considers decidedly too low. The flow of water from the uplands to the valleys is, however, by no means uniform, since in the winter the rainfall takes the form of snow, so that the volume of water brought down by the rivers is at its greatest from May to July, when the snow melts on the mountains. Storage, therefore, becomes necessary, and here again the nature of the country renders it peculiarly adaptable for such storage. The mountain lakes which abound have frequently very contracted outlets, hence they can be converted at comparatively little outlay into valuable reservoirs, which in many cases increase the natural power of the watershed some seven or eightfold, as will be instanced later. Another favourable feature characteristic of the Norwegian waterfalls is the concentration of great power obtaining at very many of the centres, the quantities available at several falls being as high as from 50,000 to 100,000 H.P. When it is added that this power can be supplied for from 22s. to 44s. per E.H.P.-year—in some cases it even reaches as low as 15s. or 16s.—it is obvious that here are ideal conditions for the establishment of great electrochemical and electrometallurgical industries, the very essence of whose existence is cheap and abundant power. The Norwegian engineers have not been slow to take advantage of the possibilities of their country in this new field of development, and we are now witnessing what is nothing less than an industrial revolution in the rapid growth of manufactures utilising the Norwegian "white coal," a revolution which will inevitably bring about a most decided shift northwards in the centre of gravity of industrial Europe. Many of the new industries have already reached an advanced state of development. Processes for the manufacture of nitrates from the air will shortly be utilising 180,000 H.P., a figure expected to rise to 300,000 in the course of the next few years, while 60,000 H.P. are already employed in the manufacture of calcium carbide. Other electrochemical and electrometallurgical industries absorb some 20,000 H.P., and this amount will be doubled in a very short time, seeing that plants aggregating 16,000 H.P. are being erected at Hardanger, Arendal, and Tinfors, for the electric smelting of iron and steel, while schemes for the electrical treatment of copper, nickel, and zinc ores, as well as for the electrolytic refining of copper, are now being considered, and are likely to be realised in practice at a no distant date.

Mr. Scott-Hansen described in some detail the several power installations around which these industries have grown up, and as many of them possess features of considerable technical interest, a brief review of the various schemes in operation will not be out of place here.

On the Glommen River, the largest in Norway, which flows down the eastern frontier of the country and into the sea near Christiania, three falls have been utilised. The uppermost fall, Kykkelsrud, owned by Schuckert & Co., yields about 40,000 H.P., of which 10,000 KW. is transmitted at 60,000 volts to Christiania, 31 miles away, and the remainder to Sarpsborg, near the mouth of the river. The water, which has a discharge, even in the winter, of 220 tons per second, is led from above the fall through a channel blasted in the rock to the power station below, where there are five sets of alternators generating three-phase current at 50 periods. The turbines are constructed with vertical axles on account of the difference of level between high and low water. At Sarpsborg occurs the lowest fall of the Glommen, and here there are two power stations—Hafslund, supplying 24,000 H.P. for carbide manufacture and zinc smelting, and Borregaard, whose output of 26,000 H.P. is utilised by the Kellner Partington Paper Pulp Co., who manufacture wood pulp, cellulose, carbide and ferro-silicon, and who own the largest works in Norway.

At Vamma, the intermediate fall on the Glommen, a great power station is at present in course of construction, and when completed it will be one of the largest in Europe, yielding some 70,000 to 80,000 H.P. The constructional difficulties at Vamma are very great, as the blasting operations have to be carried on in the winter, when the river can flow through one only of the two channels into which it has been divided. Another great difficulty arises on account of the timber-floating that is an important feature of the Glommen, and for which provision has to be made. The dam when complete will have a height of 90 ft., and the power station, containing 10 or 12 7,000-H.P. units, will be in the centre of the river immediately below it.

Among the smaller electrochemical works on the south coast are the electro-iron and steel works at Arendal, already referred to, the experimental nitrate works of the Badische Analin und Soda Fabrik, at Christianssand, and nickel and aluminium works near the same town. The former of these turns out 400 tons of pure nickel per annum. At Gjössingfjord, Mr. Albert Hiorth has a small experimental steel factory, while at Vadheim, on the west coast, is a sodium factory, and at Trondhjem, farther north, is the Meraker carbide, ferro-titanium, and ferro-chrome works.

The second of the great power centres is in the Telemarken district, some 80 or 90 miles west of Christiania. Here we have Svaelgfoss power station, which supplies 40,000 H.P. to the well-known works at Notodden, where nitrates of lime, soda and ammonia are made from the air by the Birkeland-Eyde process. The river at Svaelgfoss flows with a rapid fall between perpendicular cliffs, and although the volume of water is comparatively small, some 75 tons per second, the effective fall is about 165 ft. At the head of the fall the river is only a few yards wide, and the dam here has raised the original level about 14 metres. A large tunnel leads the water to a reservoir, whence it is conveyed in four flumes through the solid rock to the turbines below, contained in a power station built up against the almost perpendicular wall of the cliff. The four 10,000-13,000-H.P. generators are among the largest in the world. They generate three-phase current at 50 periods and 10,000 volts, and this is conveyed to Notodden, 4 kilometres away, without transformation. As a result of some damming operations on the large lakes which feed the river here, the flow of water will shortly be very materially increased, and this increased flow will be utilised in a new power station now in course of construction.

Another great power station in the same district is that now being built at Tienfoss, lower down the river. Here a concrete dam 17 metres high has been thrown right across the river, and the power station directly below it will be capable of producing 20,000 H.P., which it is likewise intended to utilise in the saltpetre works at Notodden. It is evident that the growth of the artificial nitrate industry is one that is taking place by leaps and bounds, and there seems little doubt that it must become in time one of the great industries of the world.

The Tinfoss power station, also at Notodden, is to generate 15,000 H.P., which will be principally utilised for iron and steel smelting.

The great Rjukanfoss waterfall, so-called from the cloud of spray which rises above the chasm into which the river precipitates itself, is also in the Telemarken district, and two great power stations, each of 140,000 H.P.—the largest in Europe—are now in course of construction here. The Mösvand dam, above this fall, provides a reservoir of about 840 million tons of water, not far short of the flood water retained by the Assuan dam on the Nile, and the building of this reservoir, at a cost of only £85,000, has increased the available water power from 30,000 to 250,000. The building of the great concrete dam, situated as it is in an Arctic clime 3,000 ft. above the sea, was attended by very great difficulties, as everything had to be transported by carts, barges, and, finally, sledges to these wild regions. The intake for the power station is provided by another dam, 5 miles below Mösvand. From this a tunnel, 4 kilometres in length, conveys the water to a reservoir entirely blasted out of the solid rock, and thence it is brought down 1,000 ft. in 10 huge flumes, each 5 ft. in diameter, built into the mountain-side, to the station below situated in a niche recessed in the rock. Another tunnel, 5 kilometres long, brings the water to the head of a second fall of 300 metres, at the foot of which is built the second power station of 140,000 H.P. The turbines at Rjukanfoss are Pelton wheels, on account of the great height of the falls. The flumes are subject to a pressure up to 30 atmospheres, and the lower portion of them has had to be constructed of welded plate 1 in. thick. The power is transmitted from Rjukanfoss to Saaheim through 60 copper and aluminium wires, where it will likewise be utilised in the manufacture of nitrogenous products. The vast scheme here barely outlined is primarily the conception of Mr. Samuel Eyde, the distinguished

engineer who had been associated from the beginning with Prof. Birkeland's nitrate process, and it has been carried out by the German Badische firm and the Norwegian Hydro-Electric Nitrogen Co.

The last great power plant Mr. Scott-Hansen described is that situated at the Tysse Falls, on the south-west coast of Norway, above the Hardanger Fjord, beloved of tourists. The catchment basin of the Tysse River consists of a number of lakes which empty themselves into the Ringedalsvand Lake, so that ideal regulation of the water supply has been effected, partly by raising the level of the Ringedalsvand by a dam, and so increasing the minimum H.P. available from 4,000 to 50,000, and partly by lowering it by means of an artificial outlet. The intake is from two small lakes below the Ringedalsvand, whence the water is led through a tunnel two miles long, to the face of the cliff and brought down in flumes 700 metres long to the power station at the foot of the Fjord below. The building of the tunnel, 1,320 ft. above the Fjord, and the laying of the flumes were attended by very great difficulties, all of which have been overcome without the loss of a single life. There are seven power units at Tysse, each of 4,500 H.P., and here again Pelton wheels have been used. Both the lines and the generators were built in Sweden. The electrical energy is transmitted by cable, now passing through a tunnel in the cliff, to Odda, at 12,000 volts, and is there used by the Alby United Carbide Factories, Ltd., and by the Cyanamide Works of the North-Western Cyanamide Co., Ltd. Some of the power will also be utilised shortly by the Hardanger Electric Iron and Steel Works, but as it is hoped to increase the supply eventually to 100,000 H.P., there will be ample scope for developments in other directions; whether in zinc smelting or in further iron and steel smelting has not yet been decided upon.

Mr. Scott-Hansen, in conclusion, dwelt with legitimate pride on the fact that these great hydro-electric developments have taken place without material injury to the beautiful scenery for which his country is so famous. They are at the same time giving useful employment, amid ideal surroundings, to many thousands of his countrymen who would otherwise have had to seek employment abroad. All this is matter for unalloyed satisfaction, and the congratulations which were meted out to our Norwegian friends after the reading of the paper by the several English engineers who have seen with their own eyes much of what Mr. Scott-Hansen so well described, will be heartily echoed by all Englishmen who appreciate what is involved in the successful realisation of vast and difficult engineering projects.

The Iron and Steel Institute.—Spring Meeting.

In some respects the annual spring meeting of the Iron and Steel Institute was disappointing. The papers were far too numerous and the subjects of too theoretical a nature to interest many but the academic members of the Institute. For all that was heard of the subject at the recent meeting, electro-metallurgy might be something unknown, and electro-metallurgical developments altogether beyond the sphere of the members of the Iron and Steel Institute. One valuable paper on the magnetic properties of some nickel steels, in the production of which, Dr. E. Colver-Glauerf collaborated with Dr. S. Hilpert, was "taken as read," and there was consequently no discussion upon it. This is a pity, as the paper, taken in conjunction with the one read earlier in the session before the Institution of Electrical Engineers by Sir Robert Hadfield, and Prof. Hopkinson forms a valuable addition, from the electrical engineer's standpoint, to a knowledge of the properties of metals commonly used in electrical engineering work. The authors set in contrast the pioneer work undertaken some 20 years ago by Prof. Hopkinson, who was the first experimenter of note to take exact measurements of the enormous temperature-hysteresis in alloys containing about 25 per cent. of nickel, with the work of other metallurgists, which has been almost entirely conducted from the metallographer's standpoint, and their results correlate with those of Hopkinson. They regard quantitative magnetic measurements as the only true means of accurately determining the magnetic properties of the various combinations formed by alloys. The measurements were made with the "Du Bois" magnetic precision balance, and a description of an interesting adaptation of this instrument to the ballastic instrument for measuring slightly magnetic steels will be found in the paper.

Two papers were presented on the subject of welding. In one of these, Messrs. E. F. Law, W. H. Merritt, and W. Pollard Digby described tensile micrographic tests on specimens of steel and wrought-iron welded by different methods. This paper shows that one method is defective in certain respects, whilst another shows certain peculiarities for which no simple explanation is possible. The other paper, by Dr. J. E. Stead, dealt more with the primary actions involved in welding. Dr. Stead lays down as the conditions necessary for successful welding that (1) the surfaces should be clean and free from any foreign infusible substance, and (2) the metallic surfaces must be in actual contact. Given these two conditions, the crystal union between the two pieces which constitutes welding proceeds more rapidly the higher the temperature. Prof. J. O. Arnold, in discussing Dr. Stead's paper, exhibited to the meeting an ingot which had been melted with 0·01 per cent. of aluminium, and which was thereby rendered entirely free from blowholes, though containing a "pipe," whereas the same metal, without aluminium, gave an ingot full of blowholes. Mr. W. H. Ellis gave an interesting account of concealed "pipe" cavities in compressed ingots, which on the upper end of the ingot being heated and forged, welded up because the solid metal bridge over the cavity had prevented oxidation. The latter is an excellent method for ascertaining whether welding occurs since it shows this to the unassisted eye more clearly than can be done by microscopical examination. Mr. Tucker was anxious to prevent the spread of an idea (suggested by Messrs. Law, Merritt and Digby's paper) that welding could not be carried out properly by the modern methods, because these were now largely employed for special work, such as large pipes with numerous branches. Prof. T. Turner and Mr. A. D. Jenkin agreed that good welding could be done if care were taken. Sir Thomas Wrightson pointed out that whilst any metal could be united by melting, few metals were capable of being welded. The latter process was analogous to the adherence of the molecules occurring on the application of pressure to water cooled to just above the freezing point; and his own experiments at the Mint some 30 years ago proved that pressure caused a similar reduction of temperature in the case of iron.

A series of interesting experiments on the corrosion of iron was reported by Mr. J. W. Cobb, who worked with the ferroxyl indicator of Walker and Cushman. He finds that a film of black oxide on iron forms a non-corrodible coating, so long as it is continuous and undamaged; but if the coating is injured, local circuits are formed and corrosion ensues. The "skin" of cast-iron behaves similarly; but red oxide paint forms a better protection, the electrolytic action being smaller in defective places. Local contact between iron silicate or iron sulphide and bright iron also forms local circuits, and similar results are obtained with iron phosphide, carbide, and impure silicon, aluminium, chromium, and vanadium alloys. Eighty per cent. ferro-manganese has a protective influence, being electro-positive toward iron. Every piece of commercial iron examined by Mr. Cobb gave electrical effects with any other, even portions of the same piece producing corrosion when in mutual contact under suitable conditions.

One matter in connection with the Iron and Steel Institute meeting which deserves mention was the award of the Bessemer Gold Medal (the highest distinction which the Institute can confer) to Prof. Henri Le Chatelier, famous for his researches dealing with the measurement of high temperatures. His thermo-electric couple is now in use in numerous industrial establishments. This admirable pyrometer has made possible investigations of the greatest commercial and scientific importance in the physics of metals and alloys. Prof. Le Chatelier's experimental work dealing with the electrical resistance of steel, undertaken with a view of throwing additional light upon the allotropic transformations of iron discovered by Osmond, have yielded very important results, and the award to him of the Bessemer Medal of the Iron and Steel Institute is an honour richly deserved.

The following is a summary of the paper read by Mr. J. W. Cobb on "The Influence of Impurities on the Corrosion of Iron": On the electrolytic theory the initiation of the corrosion of iron is regarded as depending on the actual contact of pure iron, and a conducting impurity immersed in or connected by an electrolyte, which may be only a thin film. Continuance of corrosion necessitates further the escape or oxidation of the polarising film of hydrogen, and also that the iron compound formed by initial corrosion on the metallic iron should not be an impervious and non-conducting covering.

Pure iron is definitely electro-positive to most of its impurities—that is, a current is found to flow through the liquid from iron to impurity, the iron going into combination with some substance in the liquid, and the impurity remaining undissolved. Among such impurities were found phosphide, sulphide, carbide, oxide and silicate of iron. With carbon (graphite) the effects were particularly marked. All the iron alloys tried (excepting ferro-manganese) were also electro-negative to pure iron. Manganese and 80 per cent. ferro-manganese were found definitely electro-positive to iron, manganese going into solution, while iron remained undissolved.

Every piece of commercial iron showed electrical effects with any other, and the effects between portions of the same piece were always sufficient to induce corrosion when the other conditions were satisfied.

Microscopic examination disclosed the same general action before noticed as occurring between iron and its impurities; the iron went into solution around the impurity. Manganese sulphide on iron went into solution, and the iron also, while with manganese silicate and iron neither was attacked. Manganese and ferro-manganese went into solution on iron, which was unattacked, and even preserved.

The presence of an impurity determines so many corrosion centres for iron, and so its influence depends more on quality and distribution than quantity; thus a more homogeneous iron, even if chemically less pure, may be more highly resistant to corrosion.

Certain rapidly appearing corrosion centres in all irons examined were not visibly related to impurities recognised under the microscope.

Messrs. C. H. Ridsdale and N. D. Ridsdale, of Middlesbrough, described the progress they had made in "mechanicalising analysis" with the aid of special standard preparations, in the shape of solvents and tablets; selected apparatus, specially marked or designed for quick and accurate measurements, and means for ensuring the right temperature, &c. The operations were concerned mainly with the analysis of samples of steel and iron, slag, &c., but the principles involved are applicable to other routine analytical processes which have to be carried out rapidly, accurately, and at frequent intervals. In the case dealt with by the authors, many valuable tests which had previously been unavailable owing to the long time required, were brought into practical use, greater all-round accuracy was attained, and a great saving of time and labour was effected; a staff which had with difficulty carried out 83,000 determinations per annum, was enabled to deal

with over 200,000, though the number of the staff was reduced by 10 per cent. The costs per determination were brought down 40 per cent. less than before the introduction of the new methods. The principles involved are, of course, applicable to similar cases in connection with other industries.

Troubles on Overhead Power Lines.

By C. W. R. Campbell.

(*Abstract of paper read before the* South African Institute of Electrical Engineers, *March 16th*, 1911.)

The geographical direction of the line has a decided influence on the effect of atmospheric disturbances, so far as I have observed in this country; the most troublesome lines are those running north and south, or in wave form over high and low ground.

Starting from the stranded steel earth wires, which it is now common practice to run over the conductors, a double tower line, about 13 miles in length, was protected in this manner, the steel wires having hemp cores. The erection of these wires was by no means an easy matter, as, in order to get the correct distances above the 40,000 and 10,000-volt conductors, it was necessary to go over the line about four times to take up the stretch, an astonishing amount of wire being cut away at each operation. During the rainy season, when the lines were in use, all went well, very little more stretch taking place; but soon after the dry season came in, they came down very rapidly, coming in contact with the conductors beneath them. This state of affairs, with six earth wires over such a distance, was a very awkward thing to handle, as they did not, of course, come down regularly, but in several places miles apart at the same time. It was impossible to keep pace with this, so all these guard wires were removed and replaced by others with steel cores.

The correct arrangement of conductors is that with the apex of the triangle on top. Where overhead earth wires are used, it would always be better to carry the top cross-arm out, so that the outside earth wire would be at least 18 in. clear of the outside conductor, if any sag or breakage took place. This would enable one, in any case, to keep the line in commission until a repair could be effected.

With insulators the chief troubles experienced beyond faulty material (which is rare nowadays) have been through flashing over caused by lightning, or by birds, and I fancy the bird trouble is the greater. I say this because of the numerous instances in which birds are found at the foot of the pole in question, with signs of burns. The curious part of this is that the bird is not always killed or even seriously injured, so that many trips on a line, or broken insulators, may be caused by birds, and yet no birds be found. I personally have seen three cases, and have heard of others. It is very necessary when designing a line in this country to bear in mind the large hawks and owls.

With regard to flashing over caused by surges and lightning, it appears that little damage is usually caused by the actual flash over. A fractured insulator is nearly always caused by the power arc following the flash over, and interesting, though somewhat expensive, methods of preventing this damage by means of earthed metallic rings surrounding the lower petticoat of the insulator have been fully described recently in the *Proceedings* of the American Institute of Electrical Engineers. The evidences of a flash over are frequently a small burn on the outer surface of the inner petticoat of the insulator, and a corresponding burn on the pin near the cross-arm.

With regard to the lines formerly in use, erected on short poles, a great deal of trouble used to be caused by objects being either blown over the lines and guard wires, or maliciously thrown over. A great source of trouble during high winds, which is not confined to lines with short poles, is from long strips of gum-tree bark and branches. These are often carried quite long distances. Other objects are kites, which can be easily burnt off with greasy waste on the end of a link stick, and iron wire. Iron wire is particularly troublesome, in that it does not easily fuse and clear itself. I have seen an instance of trouble from this cause, in which the arcing travelled 1,300 ft. before finally clearing, cracking and burning ten insulators, and damaging ten strands of wire *en route*.

Main transmission tower lines are not very subject to these troubles, being so much higher.

A point of interest is the method of binding the conductors on the insulators. From the repair-gang's point of view, and I also think from the point of view of cost, the ordinary binding wire is, perhaps, preferable to any form of clamp. If clamps are used on long spans, the strain at the moment of breaking is bound to bend over a certain number of insulator pins, which would have to be replaced; whilst with binders the copper slips through and saves the pins. In all cases of the wire breaking through on long span lines, it has been necessary to pull up the whole length from shackle to shackle, sometimes a kilometre apart, but no pin insulators have been replaced. Turning to the long-span construction with suspension type insulators for shackling at corners and certain definite distances and pin-type intermediate, several breakages of the suspension type have occurred. It is generally very difficult to diagnose the trouble; in some cases it is, I believe, owing to the straps not bedding properly on the porcelain, any extra strain during very high wind cracking the porcelain, and the shock breaking through the other insulators in series. In several instances—in fact, in most—it has been possible, after the first trip caused by the breakage, to continue to keep the line in service, the shackles on the other side of the tower supporting the conductor. The reason for the conductor itself generally holding up is that the burning is confined to the U pieces of the suspension insulators, which clear themselves.

When a line runs through a dip, trouble is sometimes caused by the line having been originally pulled up too tightly during the hot season. On the first frosty night it contracts and pulls away from the binders, in some cases even coming in contact with the cross-arm above. I remember one case of a shackle pole on a short span construction being pulled some distance out of the ground from this cause, considerable damage resulting to the insulator-pins on the pole on each side. If there had been a base on this pole something would have had to go.

With regard to pole lines in soft ground, great care has to be observed in avoiding chances of wash-outs during heavy rains. An exaggerated case of this occurred two years ago, when a pole carrying a 10,000-volt line was one morning found with the earth round its base clean washed away, the edge of the base luckily resting about 2 in. on a small water-pipe which crossed the stream, the top being held in place by the conductors themselves.

When a long straight length of line runs through soft ground, it is essential, to avoid trouble, to put plenty of wind-stays. In any long length of straight line where poles are used, it is preferable to stay the shackle poles on all four corners to avoid the trouble spreading in cases of line-breakage.

With regard to the staying of poles, an annoying source of trouble is a cow or mule rubbing itself against the stay, and setting the conductors and earth wires swinging. It is generally bad for the cow or mule, and expensive to the owners of the line. Barbed wire is recommended by some to prevent this, but I have myself seen a mule revelling in the additional aid to his enjoyment: and fencing round the chief danger points seems to be the only remedy.

Trouble has frequently occurred through the guy rods not having been set in a direct line with the pull. The safest plan is to undercut the hole for the plate, and cut a slot in the ground for the rod: this disturbs the ground very little, and the guy needs little attention after.

Jumpers from the main line to the branch line links are sometimes connected straight on to the metal carrying the link contacts. This is bound in time to cause trouble if the links are on a separate pole, owing to the constant movement gradually loosening the links. The jumpers should invariably be carried to a separate insulator on the link-pole, and then connected by a lead as flexible as possible to the link contacts.

The older type of links were usually carried on the top of pin-type insulators; these were very inconvenient to handle, and the suspended type should always be used. It is important to carry all wiring to the links on the top of the frame, so as to allow the space below them to be absolutely clear for operating safely.

Mr. Bernard Price (Vice-President) said that in the course of 12 months they would be running lines at 80,000 volts in this district, and judging from the published experience of companies operating at 100,000 volts, many of the troubles which they experienced at the lower voltages might be expected to disappear. He believed that one did in the region of 100,000 volts, reach a point where the insulation provided for the lines approached the amount necessary to deal with the high-frequency overhead effects which took place at times of lightning discharge, and of course the space between the conductors was sufficiently large to prevent flashing over.

Mr. A. E. Gibbs (member of Council) said that a point of interest in long overhead power lines was that, while still dead and free at either end, quite a heavy shock could be received from it, and when building a long line it was necessary to earth it at frequent intervals. On a fine dry windy day one could get a big shock on the lines.

Mr. G. A. Webb (member of Council) said he had been able to obtain a much heavier discharge from these lines when there was a very intense sun. He once had trouble with some guard wires owing to expansion and contraction, and got over the difficulty by using eye-bolts about 2 ft. 6 in. long, and placing spiral springs of suitable dimensions between a back plate and the cross-arm. This arrangement answered perfectly. When contraction took place there would be no elongation of the conductor, the contraction being taken up by the springs.

Mr. Bernard Price said he had been told that troubles on certain circuits which were very frequent and could be almost predicted to occur when a storm came along, were entirely overcome by connecting the lines at each end to a certain length of cable before entering the sub-station or switch gear.

Mr. G. Nowlan (member) said that the breaking of power lines was not always caused through the binders being too tight, or the wind, but by an electrical effect, because in carrying out a test at a fairly high voltage, if they had a long stretch of wire not supported, after a time it would set up a swinging movement. If they stretched a long wire, say 16 gauge, to anything over 60 ft., and put anything up to 20,000 volts on it, it would start to swing sufficiently to touch the wall 2 ft. away, on either side, unless it was bound in the middle. This was the cause of many breakdowns supposed to be merely due to mechanical troubles.

Fire at Canadian Electrical Works.—The *Montreal Witness* for May 8th says that on the previous Saturday night a fire broke out in the testing building at the works of the Allis-Chalmers-Bullock Co., Rockfield, doing damage estimated at $75,000 to $100,000.

France.—A company has just been formed in Paris (32 Rue la Rochefoucauld), with a capital of £20,000, and the title La Société Générale de l'Accumulateur Electrique.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PROPOSED NEW SWEDISH TARIFF.

(*Continued from page* 823.)

Electric locomotives, steam turbines and internal rotatory parts of the same imported separately, steam engines and steam locomobiles; water turbines; pumps, all kinds, fans, ventilators, compressors, brake appliances for railway and tramway vehicles; also other machines and apparatus not specially mentioned in the tariff, and pneumatic tools ...	10% ad val.
NOTE.—Fans fixed to electric motors pay the duty applicable to the motors.	
Steam and other cylinders, worked, imported separately, for machines of all kinds:	Per 100 kg.
Weighing each not more than 100 kg. net	55
Weighing each more than 100 kg. but not more than 200 kg. net...	30
Weighing each more than 200 kg. net	16
Pistons worked, imported separately, with or without piston rods, for machines of all kinds:	
Weighing each not more than 25 kg. net	55
Weighing each more than 25 kg. but not more than 50 kg. net	30
Weighing each more than 50 kg. net	16
Crankshafts and connecting rods, all kinds:	
Polished (turned) bright, or otherwise finely worked	10
Other	6
Transmission appliances, including axles, bearings, pulleys, cogwheels with unworked cogs:	
Weighing per article not more than 500 kg. net	6
Of greater weight	4
Electrical machines, such as generators, motors and converters, also transformers and damping rollers, weighing:	
Not more than 50 kg. net each	70
More than 50 kg. and not more than 100 kg. ...	50
" " 100 " " " 500 " ...	35
" " 500 " " " 3,000 " ...	25
" " 3,000 kg.	18
N.B.—Electrical machines joined together on one bed-plate are dutiable separately.	
Stators, rotors, current collectors, magnet poles, brush holders and coils when imported separately	Dutiable as electric machines, with an addition of 50 %.
N.B.—The duties under this and the previous heading shall in all cases amount to at least 10 per cent. *ad val.*, and shall in no case be less than the amount fixed for the most highly taxed article in the next lower group of weights.	
Accumulators:	
Unmounted cells, wooden frames and platforms belonging to accumulators, and imported at the same time, accumulator plates with wooden disks and parts belonging to them, rectangular glass jars of a capacity of at least 3·5 cb. decimetres for accumulators, and wooden boxes lined with lead, also galvanic elements	10
Cells and batteries wholly or partly mounted, also electrodes cemented together	32
	Per kg.
Incandescent lamps:	
With carbon filaments	1·50
With filaments of metal wire	4·00
NOTE.—No deduction in weight is allowed for boxes, paper and similar receptacles.	
Arc lamps, even if with the globes belonging to them; so-called Nernst lamps, with globes, luminous bodies and resistances for the same; also reflectors	0·50
NOTE.—No deduction in weight is allowed for boxes, paper and similar coverings.	
Carbon filaments, even if metallised, metal filaments and bases for incandescent lamps	Free
Carbon, not specially mentioned, manufactured for electrical purposes:	
Weighing 3 kg. net or more per article	0·03
Of less weight:	
Carbon brushes, even if in combination with other material	3·00
Other kinds	0·20
NOTE.—No reduction in weight is allowed for boxes, paper and similar coverings.	
Safety appliances, mounted on porcelain insulators (not plates); reduction, regulating and combination resistances; controllers and other electric regulators; also boards for electric apparatus and instruments, fitted	0·35
Safety appliances, not especially named, including also safety plugs, fusible pieces, cartridge pieces and excess voltage apparatus	0·50
Current regulators (current interrupters and reversers):	
Oil transformers and box transformers	0·55
Other kinds	0·75
NOTE.—No deduction of weight is allowed for boxes, paper and similar coverings.	
Telephone apparatus:	
Weighing less than 5 kg. net per article	1·50
Of greater weight	0·80
Telegraph apparatus, telephone switches and telephone switchboards; also parts, not specially mentioned, of telephone and telegraph apparatus and of telephone switches and switchboards	1·50
NOTE.—In assessing duty on the parts referred to no deduction in weight is allowed for boxes, paper and similar coverings.	
Insulating pipes (Bergmann tubing and the like) and bends for conduits, with or without connecting sleeves attached, also boxes for the same	0·20
NOTE.—So-called micanite tubes are dutiable as manufactures of mica.	
Special apparatus for electrical purposes, not separately named, such as apparatus for signalling or conveying messages, Röntgen ray apparatus, apparatus for wireless telegraphy and telephony not falling under any other heading, ore separators, &c.; also jack panels for telephone switchboards	10 % ad val.
Electric meters and other electric measuring apparatus	10 % ad val.

PATENTS EXPIRING IN 1911.

(*Continued from page* 824.)

21,704. September 22nd, 1897. "Secondary batteries." S. W. HART.—The grid is formed with cells in rows facing alternately in opposite directions, and backed with a lattice arrangement. In casting the grid the parts project at right angles from the plate, and are subsequently turned down to form claws to aid in holding the active material in place.

22,216. September 28th, 1897. "Measuring electricity." BRITISH THOMSON-HOUSTON CO., LTD. (W. H. Pratt.)—Motor meters are made astatic to prevent fields from external sources from appreciably affecting them. For this purpose two oppositely wound armatures are placed near together, and two brake disks and sets of magnets are employed. Both armatures may be connected to one commutator and across the mains. One armature only may be within the main field, but for very large currents the armatures are acted on equally by a straight conductor arranged between them. Shunt field coils to facilitate starting act on the upper armature only.

23,289. October 9th, 1897. "Telephones: telephone systems." W. P. THOMPSON. (Strowger Automatic Telephone Exchange.) Relates to automatic telephone exchanges such as are described in specification No. 8,607 A.D. 1894, in which each subscriber is provided with a set of three keys arranged to operate, by means of magnetism, a shaft capable of sliding longitudinally and also rotating axially. The lines at the central station are arranged in groups transversely to the contact shafts; the number of shafts corresponds with the number of subscribers. The part of the shaft which is over the groups is divided into insulated sections corresponding to the groups, and has a wiper capable of making contact. The wipers are set radially round the shaft in a spiral form. The bearing of each section is connected by a wire to one of a subsidiary series of transverse selecting wires, contact with which is made by wipers loosely mounted on but insulated from the shaft. This set of wipers may be replaced by a radial arm arranged to make connection with a circular set of contacts in place of the wires. The armature of a magnet first operates a ratchet wheel through a rock shaft and pawl carrying arm; after the shaft has been moved longitudinally, the lever connected to the armature of the magnet is freed to operate the rachet wheel fixed on the shaft so as to rotate the wipers. The longitudinal movement of the shaft is effected by a circular rack which is moved by a pawl on the armature lever of another magnet. The stud is a stop and tripping device, by which the pawl is held when the shaft is returned to its initial position by the spring. The armature of the magnets are so arranged that, while the selecting currents are being sent, the connections between the outer circuits and the transverse wires are broken, but on the completion of the selection, the magnets themselves are cut out, and contact is completed direct to the transverse wires.

25,816. November 6th, 1897. "Electric insulators." D. SINCLAIR and W. AITKEN.—Insulators are formed in two parts screwing together, the inner part being provided with a groove for receiving an insulated branch or test line. In place of the groove a bolt may be drilled below the collar to receive and support the insulated branch.

28,159. November 30th, 1897. "Lighting railway carriages, &c." S. WATKINS. (American Railway Electric Light Co.)—The generator is carried on the axle of the car, and means are provided for automatically regulating the current and for maintaining its flow constant as to direction though the rotation of the armature is reversed. A bearing sleeve is also described for carrying the armature. The dynamo is enclosed in a casing, and is supported partly by the axle and partly from the undercarriage of the truck, a lug on the frame resting on a spring. The current is regulated by varying a resistance in the field magnet circuit, an arm being moved over the contact disk by a ratchet mechanism controlled by an electromagnet in the main circuit. The coil has a movable core pivoted to the bottom to an arm and normally forced upwards by an adjustable spring. A shaft rotated by worm gearing from the armature, carries a crank engaging with a fork on a rocking shaft carrying pawl fingers adapted to engage when in the proper position with one or other of the reversed ratchet wheels on the shaft of which the contact arm is carried. When the current exceeds the limit, a core with its extension is drawn down, allowing the finger to engage a wheel which causes resistance to be put in the circuit. When, however, the current falls, the core rises under the action of the spring and one of the fingers comes into play and cuts out resistance. In order to automatically reduce the action of the spring when the lights are in use, a magnet is included in the circuit, its armature being attached to a lever which is connected at one end to the spring. The current is kept constant as to direction in the external circuit by a rocking reversing switch which is controlled by means of a sleeve having a helical groove in which works a stud connected to the switch arm.

24,962. October 20th, 1897. "Ordnance." Vickers, Sons & Co., A. T. Dawson and G. T. Buckham.—Discharging by means external to breech mechanism. The gun is discharged by an electric current controlled by a pistol. The trigger is connected to a heavy pivoted lever, the other end of which carries an insulated plate. When the trigger is pulled, the plate touches the spring plunger and closes the circuit. To prevent the gun from being accidentally discharged prematurely, the circuit is arranged to be always open, except when the gun is in its forward and firing position.

27,380. November 22nd, 1897. "Electric cut-outs, &c." G. M. Sellick.—The covers of cut-outs and other fittings are secured in position by a screw or bolt made of porcelain or the like non-conducting material which engages with a threaded opening in the base.

27,598. November 24th, 1897. "Electric cut-outs." G. Byng.—In order to minimise danger from arcing, the fuse wire is led through a chamber or compartment lined with a refractory material which will not volatilise at the high temperature of the arc. The base, cover, &c., may be of china or the like with suitable partitions covered or lined with plaster of Paris, cement, fire-clay, &c. In modifications, the fuse wire is led through a tube or handle suitably lined.

(To be continued.)

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,045. "Apparatus for operating electric-motor controllers and the like from a distance." J. A. Hirst and P. S. Brook. May 8th.

11,090. "Positive plates for storage batteries and processes for the manufacture thereof." P. G. Salom. May 8th.

11,109. "Devices for preventing interference in wireless telegraphy." Sir O. J. Lodge and A. Muirhead. May 8th.

11,132. "Telephone transmitters, receivers, or like devices." W. M. Crowe and British L. M. Ericsson Manufacturing Co., Ltd. May 8th. (Complete.)

11,140. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 8th.

11,162. "High-frequency transformer, especially suitable for use in wireless telegraphy and telephony." R. Goldschmidt. (Convention date, May 9th, 1910, Germany.) May 9th. (Complete).

11,182. "Dynamometers." Heenan & Froude, Ltd., and A. B. Cleworth. May 9th.

11,195. "Means for electrically-indicating or recording the position, time and speed of trains on railways." N. T. Jones-Miller. May 9th.

11,209. "Method of and means for varying electrical capacity and/or induction." A. W. Isenthal. May 9th.

11,215. "Process of treating aluminium articles for the formation thereupon of galvanic metallic coatings." C. Rumpler. (Addition to No. 23,359 of 1910. Convention date, August 5th, 1910, Germany.) May 9th. (Complete.)

11,234. "Thermo telephones." W. E. Lake. (B. Gwozdz, Germany.) May 9th.

11,237. "Intercommunication telephone systems." Sterling Telephone and Electric Co., Ltd., and F. G. Bell. (Addition to No. 1,631 of 1910.) May 9th.

11,238. "Electric time switches." J. G. Mehne. (Addition to No. 14,052 of 1909.) May 9th. (Complete.)

11,242. "Electric heating devices." British Thomson-Houston Co., Ltd., and B. Bingley. May 9th.

11,267. "Dynamometers." Heenan & Froude, Ltd., and F. Harrison. May 10th.

11,270. "Apparatus for indicating earth leakage in electric circuits, and or to cut out an installation in a leaky circuit." S. Williams and J. McCallum. May 10th.

11,275. "Arc lamps." C. G. Perez. May 10th. (Complete.)

11,310. "Electromagnetically-operated switch and like arrangements." British Electric Transformer Co., Ltd., and W. McWilliam. May 10th.

11,311. "Apparatus for use in the distribution of alternating currents." British Electric Transformer Co., Ltd., and A. F. Berry. May 10th.

11,322. "Device for reducing expenditure in electricity." A. Casagrande. May 10th. (Complete.)

11,326. "Electrical resistances." Firm of C. Schniewindt. (Convention date, May 18th, 1910, Germany.) May 10th. (Complete.)

11,339. "Transmitters and receivers for wireless telegraphic and telephonic apparatus." E. Bellini. May 10th. (Complete.)

11,349. "Electromagnetically-operated devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 10th.

11,350. "Controlling means for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 10th.

11,351. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 10th.

11,362. "Device for absorbing moisture and rendering it innoxious at the mouth of telephone transmitters, speaking tubes, and the like." W. C. Hickmutt. May 11th.

11,407. "Wireless telegraph transmitting stations." H. Murray. May 11th.

11,414. "Shade-holders for incandescent electric lights and the like." J. Watkinson and A. E. Payne. May 11th.

11,428. "Electrically-heated hair-curling tongs." E. F. Oakshott. May 11th.

11,436. "Combustion bridge for arc light electrodes." R. W. James. (Ges. fur Verwertung technischer Patente m.b.H., Germany.) May 11th. (Complete.)

11,456. "Automatic electromagnetic railway signalling devices." A. Aurilla, G. Attimo and G. Casoria. May 11th. (Complete.)

11,505. "Time-recorders for tramcar and like systems." A. C. Krause. May 12th.

11,548. "Electric heat regulator." F. Schneider. (Convention date, June 9th, 1910, Germany.) May 12th. (Complete.)

11,551. "Insulating sockets." P. Kuck. May 12th. (Complete.)

11,580. "Electric hand-lamps." E. A. Hailwood. May 13th (addition to 436/11.)

11,602. "Electric lighting for vehicles." W. Haccou. May 13th.

11,608. "Electromagnets." A. G. Sanderson and F. E. E. Truman. May 13th.

11,609. "Electric welding." T. E. Slaughter. May 13th.

11,636. "Process for treating finely sub-divided substances by electric osmose." B. Schwerin. May 13th. (Complete.)

11,638. "Sheathing for electrical conductors." W. T. Henley's Telegraph Works Co., Ltd., and J. H. W. Pfeffner. May 13th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Telephone Systems. T. G. Martin. 1,299. January 18th.

Telephone Systems. A. E. Keith. 1,421. January 19th.

Telephone Systems. E. D. Fales. 1,422. January 19th.

Telephone Systems. Dicker. (Automatic Electric Co.) 1,423. January 19th.

Electrical Systems intended more especially for the Lighting, Heating and Ventilating of Railway Trains. J. Stone & Co. and A. H. Darker. 6,666. March 16th.

Control Systems for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 9,171. April 15th.

Method of and Means for Controlling Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 9,199. April 15th.

Control Systems for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 9,276. April 16th.

Devices for Controlling the Speed of Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 9,278. April 16th.

Regulation of Dynamo-Electric Machines. B. Balachowsky and P. Caire. 9,378. April 18th. (April 16th, 1909. Addition to No. 23,742 of 1902.)

Protective Apparatus for Alternating-Current Distribution Systems. G. Harlow and K. M. Faye-Hansen. 9,603. April 20th.

Electric Ovens. H. Gray. 9,611. April 20th.

Incandescent Electric Lamps. A. W. Beuttell. 9,615. April 20th. (April 21st, 1909.)

Material for Electrical Insulation, and Process for the Manufacture of the said Material. W. F. Reid. 9,858. April 22nd.

Electric Furnaces. J. Härden. 9,897. April 23rd.

Electric Switch Mechanism. British Thomson-Houston Co. and E. B. Wedmore. 11,707. May 11th.

Variable-Speed Dynamo. C. T. Lehmann, W. (Ross-Harvey and G. Inrig. 12,651. May 24th.

Electric Change-Over Switches. A. H. Adams and Adams Mfg. Co. 12,701. May 25th.

Protective Devices for Electric Distribution Systems. British Thomson-Houston Co. (General Electric Co.) 14,512. June 15th.

Armoured or Protected Electric Switches and Fuses. H. J. Dean. 15,684. June 30th.

Driving Connection for Electrically Propelled Vehicles. W. Cooper. 18,850. August 10th. (September 10th, 1909.)

Process for the Manufacture of Fireproof Electrically-Conductive Materials. Geb. Siemens & Co. 19,866. August 25th. (October 4th, 1909.)

Electric Time Switches. W. C. Pugh and H. Gamblee. 22,368. September 27th.

Switch for Use with Electric Horns. H. Lucas and W. H. Edwards. 22,481. September 28th.

Electric Switches adapted to be Operated at Predetermined Times. V. Hope. 24,439. October 21st.

Electro-Dynamical Couplings. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 28,940. December 13th.

1911.

Galvanic Batteries. A. Heil. 207. January 4th. (January 4th, 1910.)

Resistance Units and the Manufacture thereof. British Thomson-Houston Co. (General Electric Co.) 252. January 4th.

Secondary or Storage Batteries. A. J. Boult. (F. W. Smith, U.S.A.) 2,017. January 26th.

Electric Bell Circuits. A. Baldwin. 2,572. February 1st. (Divided application on No. 25,801 of 1910.)

Means for Connecting Electric Wires to Lampholders. A. T. Crosher. 1,614. January 21st.

Ventilation of Dynamo-Electric Machines. Siemens Bros. Dynamo Works, Ltd., E. O. Kieffer and M. Kloss. 2,317. January 30th. (Addition to No. 5,118 of 1910.)

Vapour Electric Devices. British Thomson-Houston Co. (General Electric Co.) 3,268. February 8th.

Spark Plug. G. C. Blickensderfer. 181. January 4th.

Ozoniser. O. Linder. 447. January 4th.

Contact-Breakers for use in Ignition Systems of Internal-Combustion Engines. A. E. Fletcher. 2,435. January 31st.

Telephone Systems. E. D. Fales. 7,876, 7,877 and 7,878. March 29th. (Divided applications on No. 1,422 of 1910. January 19th.)

Arrangement for Electrically Transmitting Compass Positions to a Distance. L. Biermasz. 7,906. March 29th.

The Embankment Lighting.—The lighting of the north side of the Embankment roadway has been greatly improved recently by the substitution of Beckflame arc lamps for the older types formerly in use; the effect is admirable, the view along the Embankment at night being very picturesque. The arc lamps on the parapet, which are really intended rather for ornament than for the practical purpose of illumination, are to be replaced by large tungsten lamps, and the lower halves of the dioptric globes, which are difficult to clean properly, will be of plain glass. These lanterns, it will be remembered, were originally designed for gas, and this is their second conversion. The changes are being carried out by Mr. C. A. Baker, electrical engineer to the County Council.

Electrical Plough.—Messrs. Rud. Sacks, of Leipzig, manufacturers of agricultural machinery, have recently sent to Sweden, to Messrs. Hollingsworth & Co., a large electrical plough, which is being exhibited in Stockholm. This is not the only electrical plough in Sweden, for Mr. L. M. Ericsson, the head of the well-known telephone firm of L. M. Ericsson & Co., has one in use on his estate of Alby. The plough imported by Messrs. Hollingsworth & Co. has four plough-shares at each end of the machine, the breadth of which is about 6 ft. It is capable of doing the work of 16 horses, is worked by two motors placed at each end of the field, and connected with it by means of wire ropes. This plough, which is about 36 ft. in length, cost about £190. It will be mostly used during the summer on large estates.